Large Filing Separator Sheet

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6. Increasing system reliability and distribution system performance, and
7. Reducing the occurrence of supply emergencies, brownouts and blackouts.

In order for these benefits to be realized the program must convince customers to become participants, reduce energy use enough that it can help meet system-wide demand, monitor performance, calculate the payments required for compensating participants, pay participants, and document achieved benefits. All of these efforts must be achieved within a regulatory environment required to provide public oversight and represent the best interests of the customer population.

Program Operations

PowerShare is a multi-state program. The state-specific programs were designed and developed over different timelines to meet the program objectives and regulatory requirements within the states in which it operates (Ohio, Kentucky, Indiana, North Carolina and South Carolina). This means that there are multiple program operational systems and approaches. The program in Kentucky is a small, limited program that operates in conjunction with the larger Ohio program. This is a multi-state program, and this evaluation focuses on the program operating in Ohio. The operations of the program are discussed below.

Evaluation Findings

The following section presents the findings of the process evaluation of the PowerShare Program.

Marketing and Outreach

The Ohio PowerShare Program is marketed primarily via the Business Relationship Managers (BRMs). However, this "marketing" effort is more than a promotional effort. The very success of the program hinges on the ability of the BRMs to identify and enroll customers who can provide cost effective load reduction. This is a technical screening function more than it is a program marketing function. If not done well (i.e. enroll participants that can deliver their contracted reductions when requested) the program's operational costs can increase and the load reduction achieved can decrease, driving the program to not be cost effective. If the marketing and enrollment effort is not focused on enrolling customers who can reduce their load within a short period of time (typically less than 24 hours) following a reduction notice, the program cannot be successful. Regardless of all other conditions, the success of the program rests first on the capabilities of the BRMs.

This is not to say that the success of the program rests only with the BRMs. The success of the PowerShare Program rests in each of the operational components along the participation path. Each of these operational components (communications, monitoring, analysis, reporting, payments, etc.) are critical path steps. However, the first operational component that must be successful is the marketing and enrollment effort that has to screen out customers who cannot or will not perform. The BRM has to screen out customers who do not have the technical and operational conditions or the management skills that lead to successful load shed performance.

Accounts which are large enough to be assigned a BRM to manage that account represent the size of customer that potentially has enough energy demand that they can be considered a possible participant. However, it is up to the BRMs to assess their accounts to determine which customers have the size of load that can be shed during a call event. A call event is when Duke Energy notifies participants that they need to shed load during a specific period of time. The target load shed needed to invite a customer to be a participant is 100kW or 10% of the customer's load, whichever is higher. That is, the customer must be capable of providing on-call load reductions of 100kW or more. A consideration for offering the program to a customer is the degree of confidence that the BRM has in assessing the customer's ability to shed at least 100kW. This means that the BRMs have to be experts about the customer's facility and their operational practices as well as their business conditions and responsibilities before they can reliably determine if a customer would be a good candidate for participation. This requires substantial skills. Some BRMs are more experienced than others and are more capable of assessing customer-specific load shed potential. However, in most cases the load shed ability of the customer is identified during discussions with the customer after the BRM has determined that they should offer the program to that account.

The BRMs rely on the customer to identify which load can be shed and estimate the impact of that shed on their operations and cost structure. An unknown but substantial percent of customers do not know the amount of load that they can shed at any given time. These customers require technical assistance in determining the amount of load that can be shed. The

BRMs are often asked to help make these decisions. An additional unknown but substantial number of customers are not interested in participating in a program that requires them to stop using electricity during periods of time when they might need that power to satisfy their internal needs or external stakeholders. This is especially the case for facilities that make a profit only when they are in operation applying the load they consume. The BRMs need to be able to sort through their accounts and work with their customers to identify not only those that would be good candidates for participation, but also to screen out those who should not be considered for participation.

However, for many customers, there is a level of flexibility that can be managed to make the program work and at the same time provide themselves with an added source of revenue. These are the program's primary targets and the customers on which the BRMs focus. For these reasons, at the present time, marketing efforts such as the use of mass media or most types of targeted media are not appropriate for PowerShare marketing. PowerShare managers do not want to spend unproductive time enrolling and processing customers who are not good candidates for load shedding, especially if these efforts also harm customer relationships or act to reduce customer satisfaction. The marketing approaches have to be tailored to meet the ability of the program to monitor, assess impacts, meet reporting requirements and be cost effective at the program level. To accomplish this balance, the program's administrative and management overhead requirements (costs to operate the program) need to be carefully coordinated with the marketing and enrollment process so that the cost effective load shed threshold informs all programmatic operational decisions, especially customer targeting decisions. As a result we are not recommending changes to the marketing efforts, but conclude that the current approach, under the current technology and operational conditions is a wise and prudent marketing approach.

In addition to the efforts of the BRMs, the Duke Energy website presents the program and participants can start the enrollment process from the website. However, the enrollment is finalized once the BRM or other Duke Energy program managers agree that the participant has the potential to reach their load reduction agreements. Once it is determined that there is the potential for load reduction performance, the customer can enter into a participation agreement.

As noted above, the marketing and enrollment approach is a balancing act that rests on the ability of the BRMs to identify and enroll high-performance customers. However, not all BRMs are equal. The range of performance of the BRM's ability to move participants into the program appears to be substantial. We use the word "appears" here because the evaluation did not address if the performance difference is a function of skill or is a function of account assignment approaches. According to the managers interviewed by TecMarket Works, the estimates of the range of enrollment-performance among the BRMs represent a quantum gap (10 fold) between the low and high performers. Confirming this performance or the causes of the various levels of performance is beyond the scope of this evaluation. However, interview results suggest that some BRMs are more confident, more skilled, or have more accounts with the capacity to reduce load than others. If Duke Energy wants the program to grow, it will be necessary to examine the performance of the individual BRMs to confirm the performance gap and, if confirmed, to determine the reasons for the gap and tailor additional training and coaching efforts needed to improve enrollment performance, if warranted. Duke should also consider BRM performance

metrics that include enrollment into the program for BRMs that have an account base that has the potential to reduce load. TecMarket Works is not suggesting that all BRMs have an account base with equal load shifting capability, and care should be taken in these efforts. Pushing BRMs to enroll participants who do not have the capability, knowledge or skills to shed load, or who do not support the load shifting need, or who see little value in the program for them or their firm should not be enrolled. These efforts could drive up operating costs while reducing the amount of load acquired per unit of operational cost.

Contracting and Enrollment

Once a customer is ready to become a participant, they must select a type of load that they will contract to provide for a period of one year. They can elect to enter into a "firm" reduction target in which they contractually agree to move to a consumption load level (or less) regardless of what their load would have been in the absence of an event. An example of the "firm" reduction is when a participant normally consumes between 8MW and 10MW depending on activities and the weather, but establishes a firm reduction level of 7MW under the PowerShare contract. Then, regardless of where they are consuming in that 8MW to 10MW range, they must drop to 7MW during a demand reduction event. If they were operating at 8MW they would need to drop 1MW. If they were consuming at 9.7MW, they would still need to drop to a 7MW. The amount of drop is not fixed, only the level at which they need to move to is established in a firm load level agreement.

The other type of contract is a "fixed" drop contract. In this contract the participant must drop their consumption by a specific amount. For example, they can contract to drop 2MW regardless of where their pre-notification consumption would have been. This contract establishes not the load that they must move to, but rather the amount of drop that they must achieve.

These two contractual conditions make up the primary contracting types and allow participants to elect a participation approach that best meets their ability to drop load. However, in addition to these contractual participation requirements, there are different triggers for how a control event is called. These conditions are also placed into the contractual participation agreements so that the events that can trigger a call are well understood by the participants who have to respond. These event triggers are summarized below. They include:

MISO Emergency (Emergency Event): If the Midwest Independent Transmission System Operator (MISO) calls an energy emergency condition, participants are required to drop load during those periods. This is a mandatory event that is typically caused by a regional emergency power supply problem.

Call Option (Economic Event): This event is triggered not by a critical shortage of power, but by a high market cost for power. In this event, Duke Energy can activate the event when the price of power becomes high enough to impact the cost of power to ratepayers as a whole. However, participants are not required to accept the event and drop load if they exercise a buy-through provision that covers the financial loss to Duke. However, they must choose their level of exposure (the maximum number of economic events per year) to such events in their contract.

Quote Option: The event is not mandatory and participants are free to choose to participate or not. Participants must specify their intention to drop a specific amount of load and achieve actual load reduction to be incented.

A customer can sign up for only MISO called emergency events, or sign up for both MISO and Duke Energy called events. Once the contract is signed by both parties, the customer becomes a participant and the program managers initiate the administrative management and results monitoring procedures to track performance and pay incentives via credits on the participant's utility bill.

Once a participant is enrolled into the program, Duke Energy needs to integrate the new participant into the efforts needed to track performance. The PowerShare Program is a complex, labor and analytically intensive program. As the new participant comes into the program, the program's professional support staff include the participant's meter records in the program's load monitoring and analysis process. In these efforts the hourly load data is uploaded to a set of analytical activities that allow the load for each participant to be monitored and tracked on a daily basis throughout the control season. Because a control can be called at any time, for either an emergency power or economic condition, the program has to operate as if each day is a potential control analysis day. The control season runs all year for emergency events; however, economic events tend to be limited to the summer season. Regardless of the date, the program needs to be able to assess the load records of all participants so that Duke Energy can calculate the amount of load reduction that is achieved at any time, but also to maintain monitoring capability and to troubleshoot problems associated with participant monitoring and load reduction tracking. The contracting and enrollment process is substantially more than having a customer sign a participation agreement.

The Decision to Call for a Load Reduction

The decision to call for a load reduction depends on the type of call needed. For an emergency event the MISO has to declare a power supply emergency. For an economic call in which load needs to be shed because of the high cost of power, Duke Energy makes the decision.

MISO Decision: The MISO is responsible for assuring the power supply needs of large regions of the country[1]. In making a decision, the MISO looks at current regional capacity and the expected demand on that capacity and the need to maintain a reserve margin. The MISO has multiple alert conditions that are tied to the reserve margin. As the reserve margin lowers (gets smaller) the MISO can call more stringent load control conditions, including the order to implement brown-outs and black-outs. It also monitors the ability of the transmission system to move power from one place to another across the region to allow power to be efficiently moved from the area of supply to the area of need. This type of call is also called an *emergency event* or *emergency call,* and these terms are used interchangeably by the program managers and stakeholders. The MISO does not need to call an emergency event if they can acquire power from an area of the country that has excess capacity that can be used to off-set demand in another area of the country.

[1] See MISO territory map in Appendix B.

The MISO monitors weather, use conditions and available power on the market. Under conditions of high temperature and high humidity, the needs of customers in the region may not be met with the number and size of generation units that can be brought online to cover that need. In this situation, the MISO informs Duke Energy of the need to reduce load and can order Duke Energy to implement procedures to reduce load. The PowerShare Program is part of Duke Energy's load reduction strategy. If the MISO orders a load reduction, Duke Energy calls an emergency load reduction and orders PowerShare participants to implement their load reduction plan. In placing a load reduction order, the MISO provides an 8 hour notification to Duke Energy. The Ohio PowerShare Program then provides a 6 hour notice to participants to reduce their demand.

Duke Energy Decision: Duke Energy can also call a load event when the market price of power is high enough that the power supply is in economic stress. There are two types of events that Duke Energy can call: a *Call Option* event and a *Quote Option* event. (These two event types are discussed later in this document.) In these conditions, the market price for power is high enough that many of the PowerShare participants are willing to sell the power that they are using back to Duke Energy. However, there is typically a number of participants who cannot (for various reasons) reduce load at any given time. Duke Energy has a regulated obligation to provide power; therefore Duke Energy cannot indiscriminately cut power to customers. Duke Energy can either buy power from the market, or acquire that power from participants at a lower cost by paying customers to drop load. This is called an *economic* event because the needed power is available on the market, but the price is high enough that it saves ratepayers money if Duke Energy acquires that additional load by paying PowerShare participants a lower than market price to drop their load.

When an event is called, Duke Energy can then use that PowerShare acquired load reduction to meet system demand without buying higher cost power off the market. The participants are paid for the amount of load that they curtail subject to agreement terms.

Participation Options for Call Events

PowerShare Ohio provides the customers with four load control participation options. Essentially these relate to the number of periods in which a load reduction can be called in a contract year. Duke Energy has the right to make economic call decisions, but is not obligated to make calls. Participants can elect to take part in one of the following contract options:

1. Emergency option – where the participant can have 5 or less MISO called events.
2. 10 call option – in which the participant can have 5 MISO and 5 economic events.
3. 15 call option – in which the participant can have 5 MISO and 10 economic events.
4. 20 call option – in which participants can have 5 MISO and 15 economic events.

Decision to Make an Economic Call

The decision to make an economic call resides at the Retail Energy Desk. However, several key technical advisors are involved in the decision to make an economic call. Input into the decision is provided by various program managers, communications managers, the BRMs, system

operators, and others. Agreement is reached within this team to make a call. Typically the decision to make an economic call is for the next day's power supply needs. However, if the power supply system appears to be entering a multi-day stress period, such as in an extended heat storm, the focus of the consideration will include the potential for a multi-day event. However, even during an extended heat storm, the decision to call an event is made each day of that period. No more than 15 events can be called in a contract year. The typical year has from 2 to 5 events.

The decision to make a call for an economic or call option event is essentially an economic decision made on behalf of the ratepayers and Duke Energy. The goal of the economic event is to reduce the cost of power to the ratepayers and to Duke Energy. This means that the energy price typically paid to the participant has to be lower than what Duke Energy would pay for that same amount of energy if it were purchased off the market. The payments made to the participants has to allow for the administration and operations of the program, and provide a Save-A-Watt incentive to Duke Energy. If the participant does not accept the call option and reduce their load according to their contract they are changed a rate for the power not provided. The decision for a quote option event is similar in principal and approach, but performance is not mandatory and the price paid by Duke Energy is offered to the participant individually for each event. Participants are then free to take the offer and reduce load, or not take the offer. There is no cost for not taking the event.

Essentially, the PowerShare Program has to find a way to buy capacity from customers at a price that provides a return to the customer, covers all program costs, and provides a return on the program investment. This is a challenging task given that Ohio's PowerShare Program is a complex with high financial tracking costs. The pricing must allow for lower costs to the participant and to the ratepayers in a way that makes the acquisition of capacity from customers financially and technically worth the effort. The decision to make a call and the price point decision process can make or break the PowerShare program.

To make this decision Duke Energy's Retail Energy Desk examines the day-ahead market price of electricity and determines if there is enough room to acquire load from PowerShare participants at a price less than needed to reward participants and cover costs. Customer satisfaction and inconvenience is a factor in this determination. In this process the price is influenced by a number of factors. The price includes a capacity factor that is essentially equivalent to treating the program as if it were a peak plant that has to be built. There is also an energy price component. The Quote Option event payment to the customers is set at about 90% of the anticipated costs to acquire and provide that power via traditional high demand power supply and the cost of capacity for that supply. This amount is then reduced by the tariff amount to set the price that is provided to the participant. For the Call Option and the emergency event call, the price is set at the contract conditions with the participant. If the price margins are available because of a high market price the program can make an economic call, and acquire lower cost power from customers than it can from buying that same power off the market. These price structures allow the program to operate, provides a revenue stream to the participant for reducing load.

This also means that the program as currently funded has few discretionary resources for making the improvements and recommendations identified in this evaluation. Unless additional resources can be allocated for automation and streamlining improvements, these changes will need to be incorporated into a gradual automation and streamlining process.

Notifying Participants of the Load Event

When an event is called, each participant receives a notice via multiple communication systems. These include an automated telephone call to their office line, an e-mail to their internet mail box, and a text message or phone call to their cell phone. To assure that the participant receives the notice they are required to respond by logging on to the internet to confirm the receipt or confirming the message via a digital response code over their telephone. Attempts to reach the participant continue until a successful contact is made. The message also informs them to contact their BRM if they have any questions. The BRMs were involved in the decision to implement the load reduction call and they are ready for the calls from their participants. The program does not have real time monitoring of the load reduction as it occurs. At this time it is not possible to determine in real-time if the program is having its desired effect. However, after the event is over, the professional program support impact analysts examine the interval load meter data to identify participants who dropped load and the degree of that drop, and those who did not drop load, and to confirm the amount of load each participant was not able to drop.

Calculating Performance and Processing Payments

After each event, the professional program staff calculates the level of load reduction performance for each participant and for the program's event as a whole. If the participant is on a firm reduction agreement the determination is made if they reduced load from wherever their load was to their contracted firm reduction level. If the customer is on a fixed reduction agreement, the staff calculates the difference between the baseline and the control period to see if the agreed amount of reduction was achieved. At this time the program does not provide reports to or a web-dash board for the participants letting them know of their load achievements. Instead the credits or penalties are recorded on their utility bill. The program is currently considering providing feedback to the participants on the load reduction that they achieve after each call event via an e-report or web dash board. However, they are also paid a per-kWh saved credit based on the energy (kWh) reduction achieved. If the participant does not make their load reduction requirements, Duke Energy calculates the difference in the cost needed to acquire that extra load, adds an administrative fee and places that charge on the participant's bill. In addition, the BRMs schedule a meeting with the participant to go over their response and to try to identify ways for them to meet their load reduction obligations. According to managers interviewed about economic events, some participants have learned to compare the costs of the non-performance charges against their production or business losses from reducing load and make decisions based on the least costly decision.

Untapped Opportunities

According to interviewed managers, the complexity of the program and the ability of the customer to understand the operational complexities limit the program's ability to expand beyond the larger customers at or above about 1,000MW. However, managers suggest that if the program's load analysis and payment processes, and the regulatory and management reporting requirements can be automated to a significant degree; and if automated feedback reporting to

participants can be applied in a way that allows them to see their impacts; or if the program can develop real-time online feedback and performance reporting, the program would be appropriate for smaller customers or customers within specific market sectors. Managers note that the commercial real estate market can provide smaller per-participant load, but can provide large load reduction as a customer segment because of the amount of property that can reduce load. Managers report that small changes to a commercial building's energy management systems can be incorporated into their energy management software that can automatically set the conditions needed to drop load during a call event. For example, managers note that chilled water temperatures can be set 5 degrees higher, or ventilation make-up air can be set 20 percent lower during these conditions. These are simple tasks for most modern energy management systems. Managers also note that in the current economic condition, when businesses are looking for ways to save money, programs like PowerShare which pay for load reduction on days when power is in short supply or when costs are high can be attractive to customers other than those over 1,000MW.

TecMarket Works agrees with this conclusion, but also suggests that before smaller load markets are targeted there needs to be effective targeting approaches that can focus on promising customers groups and streamlined enrollment processes that allow customers to learn about the program. In addition, participants will need an introduction process that allows them to understand what they need to do to drop load and gain an expert understanding of how that load reduction will be accomplished and how those efforts will impact their productivity or operations. Without the BRMs to respond to the needs of the smaller customers, the program will need to be self-supporting. Likewise, as noted by the interviewed managers, there would also need to be streamlined or fully automated impact analysis processes and participant feedback processes. Assigning technical staff to calculate load impacts for small accounts may not be the best use of staff resources.

There may also be a need to have a different set of participation options and call events tailored for the smaller customers, such that customers can opt-out of a call with minimum penalties if any, and change their level of involvement so that they have some options consistent with their operational needs on a given call day. Options to consider may include something like a red-yellow-green option that allows participants to respond to the call in a way that matches the severity of the call, with flexibility on the number and type of responses within the red-yellow-green severity scale. Other options include being able to provide load with the flexibility to offer reductions from multiple buildings or locations within the territory. However, some of these changes would require that many smaller customer meters be updated as a condition of enrollment. And to the extent possible, it would mean that bi-directional meter communication and integration with the customer's energy management system may have to be developed and tested for performance and reliability. These opportunities need to be carefully considered as part of a longer term systems development strategy, potentially incorporating Smart Grid technologies and communications capability.

Annual Testing of the Program's Systems

Each year the program's operational systems are tested. The test is conducted in April or May prior to the control period. During the test, a schedule is set to represent a demand reduction call. The program managers and staff test the communications system (this is a communications

test, not a load reduction call). This test also interfaces with the participants in that the participants are asked to log onto the web tracking system and respond to the communications as if it were a real event. This tests not only the communication systems, but also tests to see if the participants understand the response procedures and if they understand that they are to implement their load reduction plan. Prior to the test, the BRMs are notified of the test and are informed that they should expect some level of participant interaction from their customers if the customers need help responding or help in understanding their obligations. Following the test the baseline pre-test load levels are compared to the load achieved during the test load reduction period. This tests the meter data and the ability to assess impacts. The periods are compared and each customer's load reduction is calculated and used to set a test payment for that load reduction. The calculations are tested and confirmed or they are repaired if there is a calculation error. The payment amounts are tested against the contract's payment conditions and type of event and the incentive is calculated. The load impact, if any, is not credited to the participant's energy bill. The purpose of the test is to make sure the customer communications, data monitoring, and calculation approaches are working well and are ready for an actual load event. TecMarket Works makes no recommendations for changes in the testing procedures at this time.

M&V and Reporting for internal and external purposes

According to interviewed managers, there has been an explosion in required program tracking and reporting that is overwhelming the ability of the program to meet these demands. This work load is also impacting the program's ability to minimize operational costs. In addition to the added analysis and reporting needed to assess each event load reductions and report impacts and process payments to the billing department, there are substantial additional M&V associated analysis and reporting demands. This demand is placed on the program to comply with both financial and regulatory reporting, reporting for the system operator, load availability projections, summer curtailment projections for state level planning, event load reduction analysis, new enrollment load potential analysis and other troubleshooting analysis for the program and for participants. The Ohio Commission requires peak impact analysis and hour-specific peak analysis, and where required, weather normalized impacts for projections. Managers noted that each of the different state Commissions require different analysis and reporting. In addition, analysis and reporting is required to supply documentation to senior management about the ability of the program to cost effectively acquire energy resources that provide a Save-A-Watt return to Duke Energy. Managers report that the combined analysis and reporting requirements have led to the need for an additional full time M&V load reduction calculation professional that must be backed up with additional analysis capacities.

TecMarket Works agrees that this level of M&V and analysis reporting is problematic, but also understands the need for the various financial and load reduction based analysis and reporting requirements. To the extent possible, the financial and load M&V and analysis reporting should be coordinated and routinized. To the extent possible, Duke Energy should work with the various information consumers and develop a set of standard reporting metrics and focus on establishing standard approaches for collecting, processing, assessing and reporting program impacts and potential capacity and financial status and conditions for the programs and for each event. This will be a challenge as each stakeholder has their own information requirements and priorities that are often somewhat inflexible. This problem is not limited to PowerShare or to the state of Ohio. In dealing with load control programs, we have found that load impact reporting is

becoming more important to system operators, commissions, power supply planners and others. In addition, Duke Energy should consider focusing effort on streamlining the load impact analysis efforts and where possible, build automated extraction and analysis routines. TecMarket realizes that this effort is already underway and has been for some time. These efforts need to continue. If necessary, Duke Energy should explore the option to hire or contract M&V and load impact analysts and programming experts to help set up these systems and train staff in their operation and maintenance if those systems can reduce analytical and reporting load in the longer term. However, if the establishment of common reporting metrics and routinized approaches cannot be achieved, PowerShare may need to adjust its overhead expense structure and incorporate the additional recourses needed into the program's operation that are recovered within PowerShare's pricing structures or through rates via the regulatory price adjustment processes.

Keeping Customers in the Program

According to interviewed managers, not all participants stay on the program after they experience a few calls for them to shed load. According to these managers, some customers do not understand the concept of not having power available when they need it, and customers do not always understand the concept of selling load that they do not use back to Duke Energy. Likewise some customers, particularly those that have limited flexibility in their work production schedules or who have difficulty meeting production obligations can have a problem providing load back to Duke Energy when it is needed. According to the interviewed managers, some customers accept these conditions as long as they have participation and event opt-out options. The managers were not sure what the dropout rate is, but report that it is not high, with an estimated drop-out rate for the last control event at about 3 or 4 Ohio participants. With about 114 participants in the Ohio program (both Call and Quote participants), a dropout rate of 3 or 4 is small and expected.

Managers also report that some participants have become skilled energy traders and look at the program as another potential revenue stream that allows them to shift work or production efforts to acquire the best revenue stream for their firm. However, managers indicate that there is a critical balance point for many customers in that the program has to be flexible enough to accommodate participant production and work needs without over penalizing them when they are not able to provide the load contracted. If managers are not able to shed load when called, and are penalized for that condition, interviewed managers report that these customers are the ones that drop out of the program as their contracts expire.

Another issue that may impact the dropout rate is the need for businesses to carefully monitor their post control period load. Businesses that respond to a call and reduce load can find themselves in the position of trying to recover from that load shed by restarting equipment and processes that were shut down, scaled down or shifted to non-control hours. If this is not carefully done, it is possible for a participant to have their payments eroded by excessive demand charges as they return to normal operations and have multiple systems coming on at the same time. Managers were not sure if the program provides advice or warnings to participants to help them understand the possibility of eroding their payments. We did not test for this condition, however we do suggest that the BRMs be advised that in some cases participants may need to rapidly recover from the load reduction achieved through the program in a way that can offset

the program's financial benefits. BRMs should screen for these conditions during the enrollment assessment process and consider if there are participants who would be better served by not being enrolled or by suggesting that when they enroll they consider moving to the on-peak/off-peak rate structure (rider LM).

TecMarket Works does not suggest changes to the contract performance options or the non-performance penalties structured into the contracts. It is important for the program to acquire participants who can perform and it is important for participants who are enrolled in the program to take their contracted responsibility seriously. Essentially Duke Energy is paying for their participation. According to the interviewed managers, Duke Energy goes over the various participation scenarios with the customer and these conditions are presented in the participation contracts. Likewise, BRMs also discuss these conditions with the participants during the marketing and enrollment process, and are often called upon to explain how the contract provisions work in the event of a call for both performance and non-performance. For the participants who more fully understand the programs and the operational requirements and who have the technical and managerial expertise to incorporate the program into their operational decision frameworks and profit streams, the programs seems to work well. However, TecMarket Works did not conduct participant interviews to identify participation issues with the participants, but rather obtained the information presented here through interviews with the program managers and the reviews of program materials. TecMarket Works is not confirming that this information is accurate, but rather we report the results of the interviews that suggest there is a small portion of the population of participants who may not be good candidates for the program, but who were approved for participation. We are not suggesting that this is a problem and this condition may not be avoidable as participants gain experience with the program and more fully understand the program's impact on their operations. These issues do not appear to be significant and we are not recommending corrective action at this time. However, if Duke Energy determines that they would like to grow the program to include smaller customers or focus on market segments, it would be beneficial for Duke Energy to explore these issues to determine if the conditions that drive program dropouts can be identified and incorporated into the program's smaller customer screening efforts to help reduce the potential for higher levels of dropouts from customers segments or size groups where this may become an issue.

Program Operational Issues

A few operational issues were identified during the interviews that are reported in this section.

Tariff price adjustments are confusing to the participants

According to the interviewed managers, the participants are informed that the price they are paid for a Quote Option is equal to ninety percent (90%) of the MISO next day price projection, less tariff adjustments. Managers report that participants do not understand the tariff concept. To many, a tariff is the cost placed on an imported product to adjust the cost of the product for some specific reason or condition. According to the managers, it is difficult for the BRMs and others to help customers understand why tariff adjustments are applied to the MISO 90% price estimate. This adjustment is substantial and can be 30 percent (30%) of the anticipated price expected by the participant. TecMarket Works suggests that the program develop materials that help the participants understand the tariff, why it is there, and the impacts of the tariff on the

Quote Option pricing structure and convey these concepts on the website, to the potential participants and within the contract agreements.

Program is labor intensive

Managers noted that the program as it is now structured is labor intensive and that implementation staff are often shared with other job functions beyond the PowerShare program, requiring the program to operate with support staff that may not be available during critical periods. Managers report that focused attention is required for information technology (IT) requirements, including problem solving, communications troubleshooting, performance analysis, as well as coordination and reporting requirements. Interviewed managers report that notification system problems, contact information maintenance, and operational problem solving require a structured focus from individuals who are experts with the operations of the program's information systems. Managers noted that support has been obtained via outsourcing some of the IT support with three different firms over a three year period, with some of the support located in other countries and staffed by people who did not understand the operations or complexity of the program support needs or understand that these can change from week to week. Managers report that solving these problems are critical for efficient program operations. Interviewed managers report that substantial progress has been made regarding these issues, but also report that there remains a need to focus additional resources on streamlining approaches and standardizing operational analysis and reporting to the extent possible. TecMarket Works agrees that establishing standardized approaches, especially for complex operational programs that require substantial communication, analysis and reporting efforts are keys to cost effective operations.

Vendor Performance

There remains some concern by multiple managers regarding the ability of their current support vendor to build and operate program management and operational systems that meet Duke Energy's needs. Managers report that the current provider is focused on developing and improving operational procedures that work for multiple programs and clients rather than developing and maintaining systems that are focused on Duke Energy's needs.

TecMarket Works did not examine or test these conditions or assess the performance of the support vendors, but include this discussion in the process report so that the interview comments on these conditions are documented. It is the understanding of TecMarket Works that Duke Energy is addressing these issues with the vendors and is taking steps to fill labor need gaps that can be accomplished within the program's resources. These issues should be minimized as the program develops additional streamlining procedures and automated performance analysis systems. In addition, Duke Energy continues to move more of the operations of the program to the service vendor and develop more advanced programming and streamlined practices with the current provider.

PowerShare has Potential to Integrate With a SmartGrid Pilot

While load control programs have been and continue to be a part of the power supply mix, these programs have the potential to benefit from newly developing SmartGrid communication and

technology control systems. Several of the interviewed managers commented on the operational and management changes that the PowerShare Program has experienced over the last 10 years of operation and how these changes are beginning to be associated with SmartGrid approaches. There seems to be a concern on the part of some of the managers that PowerShare is not seen as a way to test SmartGrid concepts and communication systems if participants can agree to take advantage of automated controls. This is a concept that needs to be explored by Duke Energy to determine if the PowerShare Program has the participant base and customer conditions that make automated load control procedures controlled by Duke Energy a possibility. On one hand the PowerShare Program services larger customers who need to maintain control over production and environmental conditions, suggesting that PowerShare decisions need to remain in the hands of the participants. In other cases PowerShare participants can move to prescriptive load control response actions that can be controlled by SmartGrid. The movements of chiller or roof-top HVAC unit set points or water heating controls are examples of systems that might be controlled by SmartGrid technologies and communication systems. However, production or service related controls are best managed by the participant to match individual customer needs and conditions.

Interactive load control is a major aspect of the Smart Grid platform and PowerShare may be able to provide a pilot test bed for the Smart Grid communications and control systems on a sub-set of participants, especially if these control systems can be automated in a way that meets customer flexibility requirements. However, this should be carefully considered and accomplished only when Smart Grid approaches and systems are well enough developed and tested enough that they are reliable and can meet the flexibility requirements of PowerShare participants. While Smart Grid holds great promise for load reduction across supply systems as well as within local distribution networks, TecMarket Works is not familiar with the state of development of these systems or the reliability of the communications and control approaches. Duke Energy is one of the leading Smart Grid utilities in the United States and has the knowledge, skill and information to assess this issue. TecMarket Works focuses attention on this aspect because it was a theme of discussion by more than one manager, suggesting there may be some level of agreement within the PowerShare management structure to examine this issue and explore its potential.

Impact Estimation Approach

The current impact evaluation approach used by Duke Energy for the PowerShare Program has changed recently from the previous single ex ante impact evaluation conducted after the summer, to series of impact evaluations that are conducted at the end of each month during the summer. The reason for this change was two-fold. First, NERC and MISO rules require impact estimates within 30 and 60 days respectively.[2] Second, participants have a strong preference to receive payments as close to an event as possible, rather than waiting for an ex post impact evaluation after the end of the summer.

In general, the impact evaluation approach used by Duke Energy consists of the estimation of a daily "pro forma load shape" (PFL) for each customer that predicts the next day's hourly load shape for each customer. The results of this model represent the customer's curtailable load. At the end of the month, a monthly PFL is estimated (using the same specification) for each customer. The load impacts and event payments are based upon this monthly PFL. The details of the PFL are discussed below.

The PFL is a regression model where the dependent variable is the customer's actual hourly load, collected from the customer's meter. The independent variables in the regression equation include variables to control for the hour of the day, the hour of the week, the hour of the month, weather conditions, event days, and "quiet" periods (which are periods of unusual loads due to such things as production slow downs or equipment down time)[3].

The PFL also includes terms to capture correlations in the error term (i.e., unaccounted for effects) that may persist over time. The model generally uses a minimum of twelve weeks of historical load data to estimate the parameters of the model, though no more than twelve months of data can be used in the model.

At the end of the month, if any events occurred, a PFL model is estimated using the actual weather conditions for the month that the control event occur, but without including the load data for that day. The customer's load profile on the event day is then estimated from this PFL (using the actual weather conditions), and compared to the customer's actual load on during the event. The difference is the event impact for that participant.[4]

Assessment of Ex-Ante Impact Estimation Approach

The movement from a single, ex post impact evaluation conducted at the end of the year to a monthly ex post impact evaluation is a significant improvement for this program by better meeting the needs of regulatory agencies providing them with a better insight into the ongoing performance of the program. Often times, ex post impact evaluations are conducted so long after

[2] Duke Energy "SAW MV proposal", Oct. 2009. Note that the PowerShare Voluntary and eventually the QuoteOption programs however do not undergo this monthly impact evaluation, and are still evaluated using an ex-ante impact evaluation. The approach used for that evaluation is identical to the one that was reviewed by the TecMarket Project Team in 2007 so our comments in that report remain valid.

[3] Duke Energy "Pro Forma Calculation Process" Jan. 2010.

[4] By including indicator variables for event hours, the coefficients on those variables in the monthly PFL essentially are the load impacts for that customer for that hour for that event, so the comparison is done within the regression equation. This approach has the added benefit of allowing for hypothesis testing (i.e., determining whether or not those impacts are statistically significant).

a program has been implemented that it has negligible value to the program going forward. Duke's ex post estimation approach provides rapid feed back to the program managers about what is occurring shortly after the control events allowing them to determine the effectiveness of both the program and individual contracts.

The technical approach used by Duke Energy in how they specify the PFL and estimate event effects appears to be reasonable and defensible. The Duke Energy model's specifications include the key determinates of energy usage, so there is little likelihood of bias in the results from omitted variables. One particularly noteworthy feature is that Duke Energy incorporates an extensive participant consumption history to estimate the model, rather than relying on a small sample of days prior to the event as is common in many utilities which use less rigorous approaches (i.e., approaches that compare average usages from a pre-event period, for example, rather than conducting a multivariate regression model, as Duke Energy is doing).

Overall, based on our review, Duke Energy's impact evaluation is a complete, innovative and reliable approach that should provide an accurate estimate of event impacts. However, since there were no control events during the summer of 2009, it is not possible to verify the accuracy of the approach. This can only be done once an actual PowerShare event has occurred.

Appendix A: PowerShare Management Interview Instrument

Name: _____

Title: _____

Position description and general responsibilities:

_____

_____

_____

We are conducting this interview to obtain your opinions about and experiences with the PowerShare Program. We'll talk about the Program and its objectives, your thoughts on improving the program and its participation rates. The interview will take about two or three hours to complete. May we begin?

Program Objectives & Operations

1. In your own words please describe how the PowerShare Program works, go over its design, marketing and operational approaches. Walk us through the participatory steps starting with a customer who knows nothing about the program.

2. Please describe your role and scope of responsibility in detail. What is it that you are responsible for as it relates to this program? When did you take on this role?

3. Do you feel that Duke Energy has provided you with enough time and resources to adequately manage this program? Did you receive the support that you need to manage this program? What else is needed?

4. In your own words, please briefly describe the PowerShare Program's objectives. Any other objectives?

5. Have these objectives changed in the last year or so, and if so how? Why?

6. In your opinion, which objectives do you think are being met or will be met?

7. Should the current objectives be changed in any way because of market conditions, other external or internal program influences, or any other conditions that have developed since the program objectives were devised? What changes would you put into place, and how would it affect the objectives?

8. Are there any conditions that are associated with the program or the market that are not being addressed or that you think should have more attention? If yes, which ones? How should these conditions be addressed? What should be changed? How do you think these changes will increase program participation or impacts?

9. Do you think the materials and information presented to the C&I community about the PowerShare Program provides a complete enough picture for them to understand the potential importance of the program to them and their operations and the incentive or participatory benefits of the program?

10. Do you think the incentives offered through the PowerShare Program are adequate enough to entice the C&I community to enroll in the program? Why or why not? What can be improved in the area of incentives or sales approaches?

11. ? Are there any changes to the incentives or marketing that could possibly increase participation in the program? What would happen if the incentives were decreased or increased, how would this impact your ability to acquire power reductions?

12. What kinds of marketing, outreach and customer contact approaches do you use to make your customers aware of the program? Are there any changes to the program marketing that you think would increase participation?

Overall PowerShare Management

13. Describe the use of any internal or outside program advisors, technical groups or organizations that have in the past or are currently helping you think through the program's approach or methods. How often do you use these resources? What do you use them for?

14. Overall, what about the PowerShare Program works well and why?

15. What doesn't work well and why? Do you think this discourages participation?

16. What are the key market or operational barriers that impede a more efficient program operation or limit obtainable impacts?

17. In what ways can the PowerShare Program's operations be improved?

18. If you could change any part of the program what would you change and why?

Program Design & Implementation

19. What market information, research or market assessments are you using to determine the best target markets or market segments to focus on?

20. What market information, research or market assessments are you using to identify market barriers, and develop more effective operational mechanisms?

21. How do you track, manage, and monitor or evaluate customer involvement?

22. Do you think there should be changes made to the participant structures? *For instance, in Kentucky's 2007 evaluation of the program, a company can opt for "quote" or "call" participation. Being "call" involves mandatory interruption, but only 2 companies enrolled. 20 companies enrolled in the optional "quote" group – but only 1 participated in the single event in 2007.*

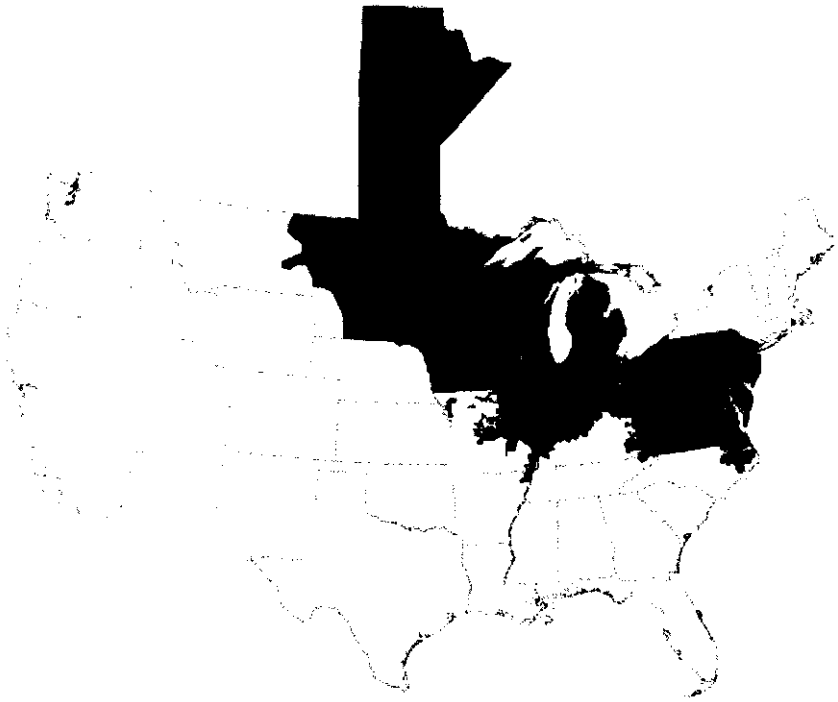
23. What is the quality control, tracking and accounting process for determining how well control and control strategies work?

24. Do you have any suggestions for how program participation can be increased?

25. Are there any other issues or topics you think we should know about and discuss for this evaluation?

Appendix B: MISO Territory Map

Red area is MISO territory.



TecMarket Business Center
165 Netherwood Road
2nd Floor, Suite A
Oregon, WI 53575

Memorandum

To: Ashlie Ossege, Duke Energy
From: TecMarket Works
Date: January 12, 2011
Subject: Ohio CFLs, Customer Survey Results

Findings

1. CFL coupons were far and away the primary driver for participants to purchase CFLs, and more than 40 % of coupon redeemers indicated that they would have purchased zero CFLs if the Duke Energy coupon had not been available.
2. While CFL coupons are driving spillover to more CFL purchases, the coupons are having only a small effect on simultaneous purchases of other energy efficiency technologies such as insulation and weather stripping.
3. Of the CFLs redeemed with coupons, 90% in Ohio and 84% in Kentucky were reported to be installed and operating in sockets at the time of the survey.
4. Prior use of CFLs had no bearing on CFL program satisfaction ratings of CFL redeemers or likelihood of purchasing CFLs in the future, however those redeemers who experienced any bulb failure or removed at least one CFL because of light quality had a lower overall satisfaction rating with CFLs.
5. Prior use did have an effect on forward-looking confidence in CFLs with more new adopters than previous adopters finding they were much more confident in CFLs after participating in the program.
6. While CFL forward-looking buying habits are similar for new and previous adopters, previous adopters indicate they are more likely to replace a failed bulb with a CFL.

CFL Coupon Redeemers

This survey focused on customers who, according to program tracking records, redeemed their CFL coupons. The survey was mailed out to customers in Ohio and in Kentucky who had redeemed their CFL coupons. Of these, 130 surveys were returned in Ohio and 41 were returned in Kentucky with usable responses.

Participation in the Program

As seen in Table 4 nearly all of the redeemers responding to the survey (95.4% in Ohio and 92.5% in Kentucky) recall using the coupons provided by Duke Energy themselves, while some (6.9% in OH and 15% in Kentucky) recall giving at least one of their coupons away to another user.

Table 1. Participation in the Program

	Used Coupon themselves		Gave coupons to someone else	
	Yes	No	Yes	No
OH (n=130)	95.4%	4.6%	6.9%	93.1%
KY (n=40)	92.5%	7.5%	15%	85%
Weighted	**94.7%**	**5.3%**	**8.1%**	**91.2%**

fax: (608) 835-9490 email: NPHall@TecMarket.net telephone: (608) 835-8855

average				

Redeemers were asked to rate the influence several categories on their decision to purchase CFLs These categories included:

- The Duke Energy CFL coupon,
- In-store advertising,
- Advertising that was not in-store, such as tv, radio and newspaper ads
- Other advertising
- CFL brand,
- Sales associates,
- Friends and family

Possible responses for each category were Very Influential, Somewhat Influential, and Not Influential at All.

Ninety-seven (75.2%) redeemers in Ohio and 28 (68.3%) in Kentucky found the coupon from Duke Energy to be "very influential" in their decision to purchase CFLs, indicating that the coupon was a key purchase driver. Although previous Duke Energy CFL studies have found the CFL coupon from Duke Energy to be even more influential, the coupon still seems to be the main driver in redeemers' decisions to purchase CFLs.[1] In-store CFL displays and signs were found to be somewhat influential, and other forms of advertising were found to be not at all influential by most redeemers. Redeemers did not find CFL branding or friends and family recommendations to be influential in their decision to purchase CFLs. As indicated in Table 5 and Figures 1 and 2, the Duke Energy coupon was the primary driver leading to the purchase of the program-induced CFL by a significant margin; however, the decision was also influenced, to a limited degree, by other events.

The only major difference from the July 2010 report was that 56.6% of redeemers indicated that in-store displays and 67.1% of redeemers indicated that media advertising were not at all influential in their purchasing decision. In the July 2010 report these numbers were 38.4% and 45.1% respectively.

Table 2. Factors influencing CFL buying decision

	OH			KY		
	Very influential	Somewhat influential	Not at all	Very influential	Somewhat influential	Not at all
The coupon from Duke Energy	97	25	7	28	7	6
	75.2%	19.4%	5.4%	70%	17.5%	12.5%
CFL Brand	21	30	78	4	12	24
	16.3%	23.3%	60.4%	10%	30%	60%
Non in-store advertising (TV, radio, newspaper, etc.)	13	43	73	3	16	21
	10.1%	33.3%	56.6%	7.5%	40%	52.%
In-store CFL displays and signs	12	42	75	7	9	24
	9.3%	32.6%	67.1%	17.5%	22.5%	60%

[1] "An Evaluation of Energy Star Products: Results of a Process and Impact Evaluation of Duke Energy's CFL Promotion and Lighting Logger Programs" prepared for Duke Energy by TecMarket Works and Building Metrics, September 24, 2008, page 38. This study will be referenced as the "2008 study" through this report.

Friends or family	12	27	90	4	9	27
	9.3%	**20.9%**	**69.8%**	**10%**	**22.5%**	**67.5%**
Other advertising	7	19	103	0	12	28
	5.4%	**14.7%**	**79.9%**	**0%**	**30%**	**70%**
Sales associates at the store	1	13	115	1	6	33
	0.8%	**10.1%**	**89.1%**	**2.5%**	**15%**	**82.5%**
Online coupon from Duke-energy.com	3	4	9	1	2	37
	2.3%	**3.1%**	**94.6%**	**2.5%**	**5%**	**92.5%**

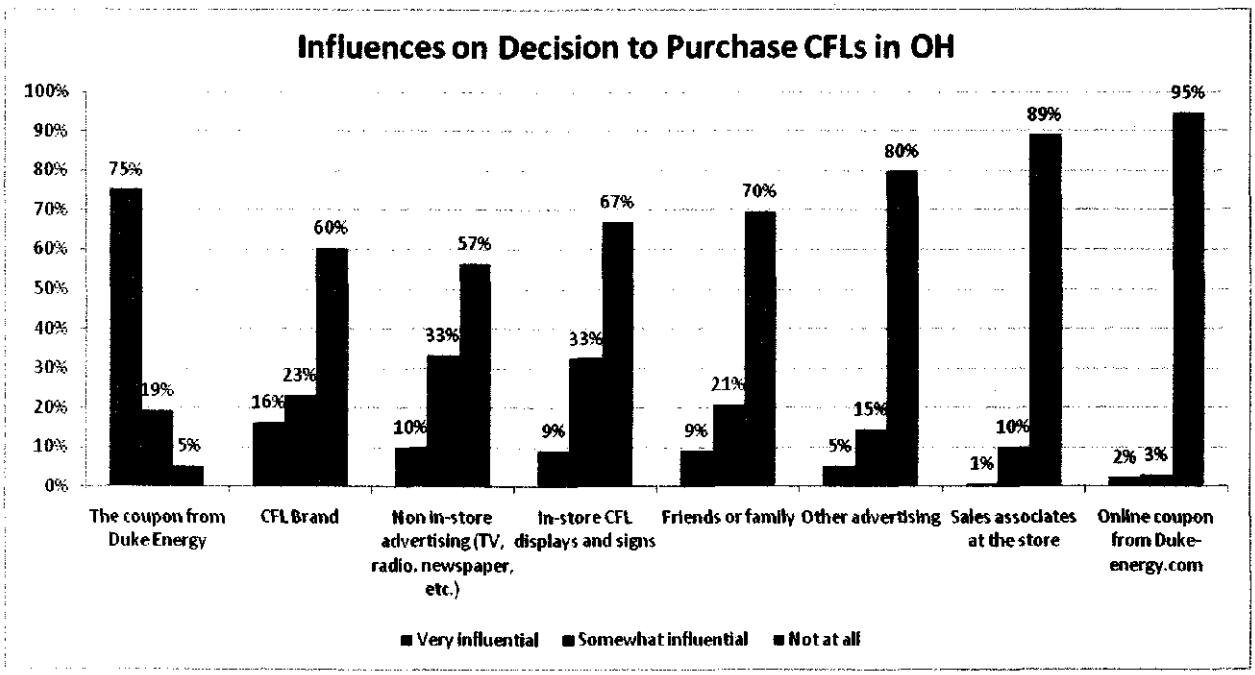


Figure 1. Influences on Decision to Purchase CFLs in Ohio

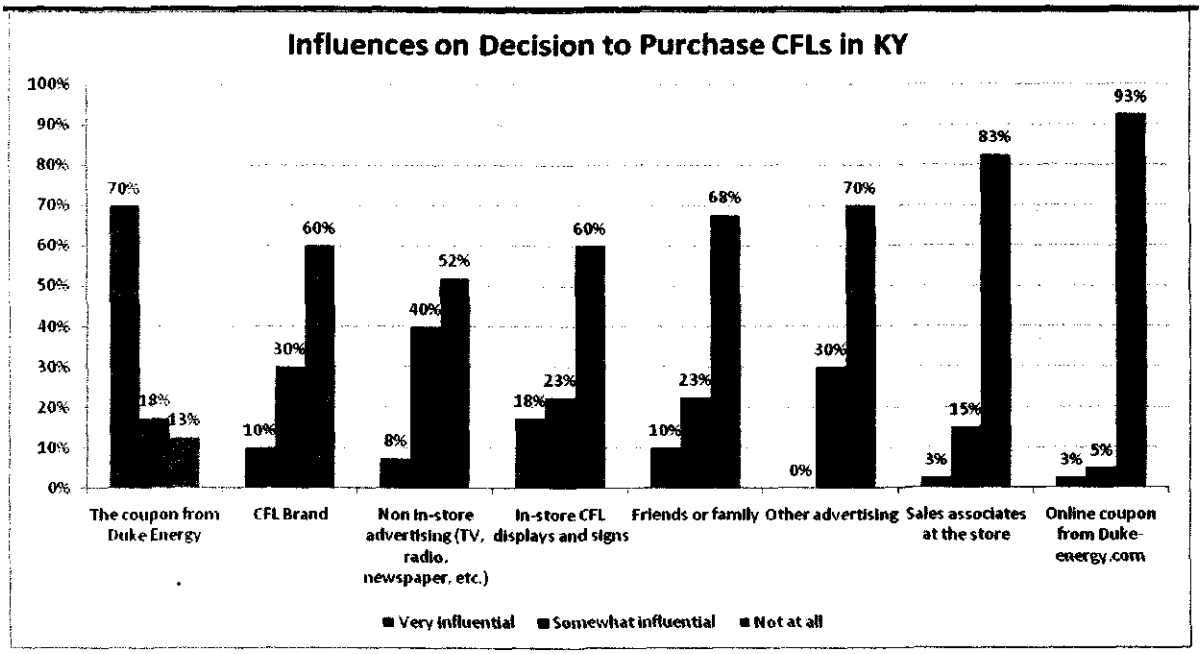


Figure 2. Influences on Decision to Purchase CFLs in Kentucky

As shown in the table below, the majority of redeemers in Ohio (76.7%) recalled purchasing their CFLs at Wal-Mart using the CFL coupons. In addition, redeemers also mentioned stores where they may have purchased CFL bulbs using the manufacturer's coupons. In Kentucky, however, 25% of redeemers recalled redeeming their CFLs at Wal-Mart while the same amount (25%) recalled redeeming coupons at Home Depot and 12.5% recalled redeeming their coupon at Lowe's.

In the July 2010 report only 36% of redeemers recalled purchasing CFLs at Wal-Mart and 24.4% recalled purchasing CFLs at Lowe's.

Table 3. Location of CFL coupons redeemed

	OH		KY	
Store	**N**	**%**	**N**	**%**
Walmart	99	**76.7%**	10	**25%**
Not specified	22	**17.1%**	8	**20%**
Home Depot	4	**3.1%**	10	**25%**
Lowe's	2	**1.6%**	5	**12.5%**
Target	1	**0.8%**	0	**0%**
Meijer	1	**0.8%**	1	**2.5%**
Ace	0	**0%**	2	**5%**
Kroger's	0	**0%**	4	**10%**

Redeemers were asked if they purchased any of the following additional items when they purchased their CFLs: wall/ceiling insulation, faucet aerators, showerheads, weather stripping, caulking, outlet gaskets, or programmable thermostats. Most redeemers did not purchase additional items when purchasing their

CFLs (80.5% in both Ohio and Kentucky). In Ohio those redeemers who did purchase additional items purchased weather stripping, caulking, outlet gaskets, wall or ceiling insulation, or a programmable thermostat. In Kentucky redeemers who purchased additional items purchased weather stripping, caulking, a low-flow showerhead, wall or ceiling information, or outlet gaskets. These numbers show little change from the July 2010 report and reflect that when program participation influences additional purchases, those typically focus on lower cost items.

Table 4. Additional measures purchased when redeeming Duke Energy's CFL coupon

	OH		KY	
Measure	**N**	**%**	**N**	**%**
None	113	**86.9%**	36	**78.0%**
Caulking	7	**5.4%**	1	**2.4%**
Weather stripping	6	**4.6%**	1	**2.4%**
Low flow showerhead	0	**0.0%**	1	**2.4%**
Faucet aerators	0	**0.0%**	0	**0.0%**
Electric wall outlet gaskets	1	**0.8%**	1	**2.4%**
Wall or ceiling insulation	2	**1.5%**	1	**2.4%**
Programmable thermostat	1	**0.8%**	0	**0%**

Use of CFL Coupons

Redeemers could have purchased between three and fifteen bulbs using the Duke Energy coupons. The majority of redeemers stated they purchased four or more CFLs, with just over half of redeemers (52.7% in Ohio and 48.4% in Kentucky) indicating they purchased six or more CFLs. This data indicates that not only was the Duke coupon the key driver for the purchase decision, but that purchase decisions typically involved four or more bulbs. A small number of redeemers stated that they purchased 1 or 2 CFLs. Since the CFLs eligible for the coupons were packages of 3 or 6 bulbs, these redeemers may have been describing the number of packages of CFLs they purchased, or they did not recall the number of bulbs purchased and were providing their best guess. The results are shown in Table 8.

Table 5. Number CFLs purchased, installed and stored for later use as a percentage of redeemers.

			0	1	2	3	4	5	6	7-11	12+
CFLs purchased with coupon	OH	N	14	2	11	7	22	3	41	13	5
		%	**11.9%**	**1.7%**	**9.3%**	**5.9%**	**18.6%**	**2.5%**	**34.7%**	**11.0%**	**4.2%**
	KY	N	1	1	3	2	7	3	9	3	4
		%	**3.0%**	**3.0%**	**9.1%**	**6.1%**	**21.2%**	**9.1%**	**27.3%**	**9.1%**	**12.1%**
CFLS installed	OH	N	15	5	16	11	24	5	24	15	3

		%	12.7%	4.2%	13.6%	9.3%	20.3%	4.2%	20.3%	12.7%	2.5%
	KY	N	2	2	4	2	7	2	8	2	4
		%	6.1%	6.1%	12.1%	6.1%	21.2%	6.1%	24.2%	6.1%	12.1%
CFLs stored for later use	OH	N	41	7	17	8	16	2	11	6	4
		%	36.6%	6.3%	15.2%	7.1%	14.3%	1.8%	9.8%	5.4%	3.6%
	KY	N	13	2	7	1	3	0	1	5	2
		%	38.2%	5.9%	20.6%	2.9%	8.8%	0.0%	2.9%	14.7%	5.9%

CFL Installation Rates

In Ohio redeemers indicated that they had purchased 579 CFLs with coupons and of those 522 (90.2%) were installed. Two hundred thirty two (232) CFLs were purchased with coupons and 195 (84.1%) were installed in Kentucky. To obtain these numbers the 7-11 choice category was averaged to 9 bulbs and the specific numbers given by redeemers who had more than 12 CFLs were used. Along with the high installation rates Figure 8 illustrates that a high percentage of program CFLs are being put installed in sockets. These numbers show little change from the July 2010 CFL report.

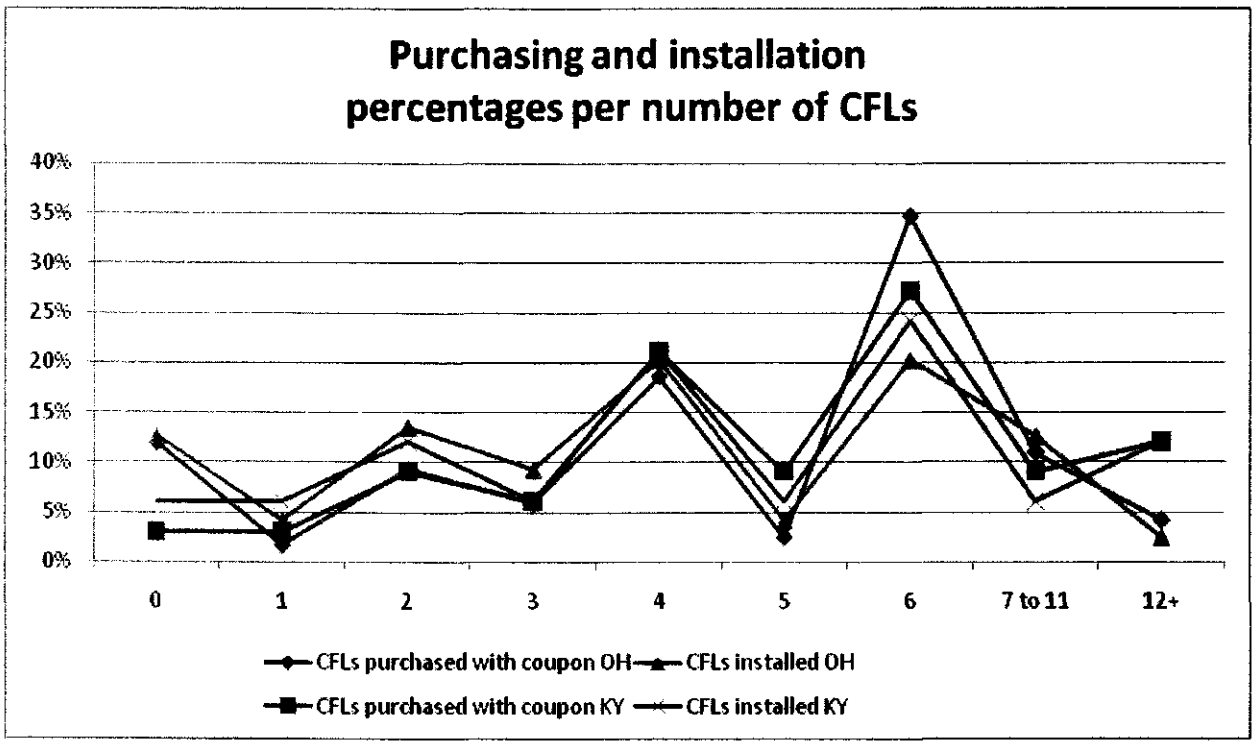


Figure 3. Number of CFLs purchased, installed and stored as a percentage of respondents

CFL Coupon Estimated Negative Influence

Redeemers were asked if they would have purchased any CFLs if the Duke Energy Smart $aver® coupon had not been available, and, if so, how many.

As shown in Table 8, more than 40% (43% in Ohio and 48.6% in Kentucky) of redeemers stated that they would not have bought any CFLs if the coupon had not been available, and an even larger number of redeemers (51.8% in Ohio and 55.6% in Kentucky) stated that they have not purchased any additional CFLs since using the coupon. These two statements corroborate the previous statement made by redeemers that receiving the coupon in the mail was most influential in a participant's decision to purchase CFLs.

In the July 2010 report 33.5% percent of redeemers estimated they would have bought zero bulbs if the coupon had not been available.

Table 6. Estimated Influence of No Coupon, Additional Purchases and CFLs given away

			None	1	2	3	4	5	6	7-11	12+
Estimated CFLS bought if coupon had not been available	OH	N	49	5	13	5	11	0	11	11	9
		%	**43.0%**	**4.4%**	**11.4%**	**4.4%**	**9.6%**	**0.0%**	**9.6%**	**9.6%**	**7.9%**
	KY	N	17	1	5	0	2	0	2	5	3
		%	**48.6%**	**2.9%**	**14.3%**	**0.0%**	**5.7%**	**0.0%**	**5.7%**	**14.3%**	**8.6%**
CFLs purchased since participating	OH	N	57	4	9	7	11	3	13	4	2
		%	**51.8%**	**3.6%**	**8.2%**	**6.4%**	**10.0%**	**2.7%**	**11.8%**	**3.6%**	**1.8%**
	KY	N	20	1	1	3	2	0	3	3	3
		%	**55.6%**	**2.8%**	**2.8%**	**8.3%**	**5.6%**	**0.0%**	**8.3%**	**8.3%**	**8.3%**
CFLs given away	OH	N	108	1	1	2	3	2	0	0	1
		%	**91.5%**	**0.8%**	**0.8%**	**1.7%**	**2.5%**	**1.7%**	**0.0%**	**0.0%**	**0.8%**
	KY	N	32	0	0	1	1	0	0	0	1
		%	**91.4%**	**0.0%**	**0.0%**	**2.9%**	**2.9%**	**0.0%**	**0.0%**	**0.0%**	**2.9%**

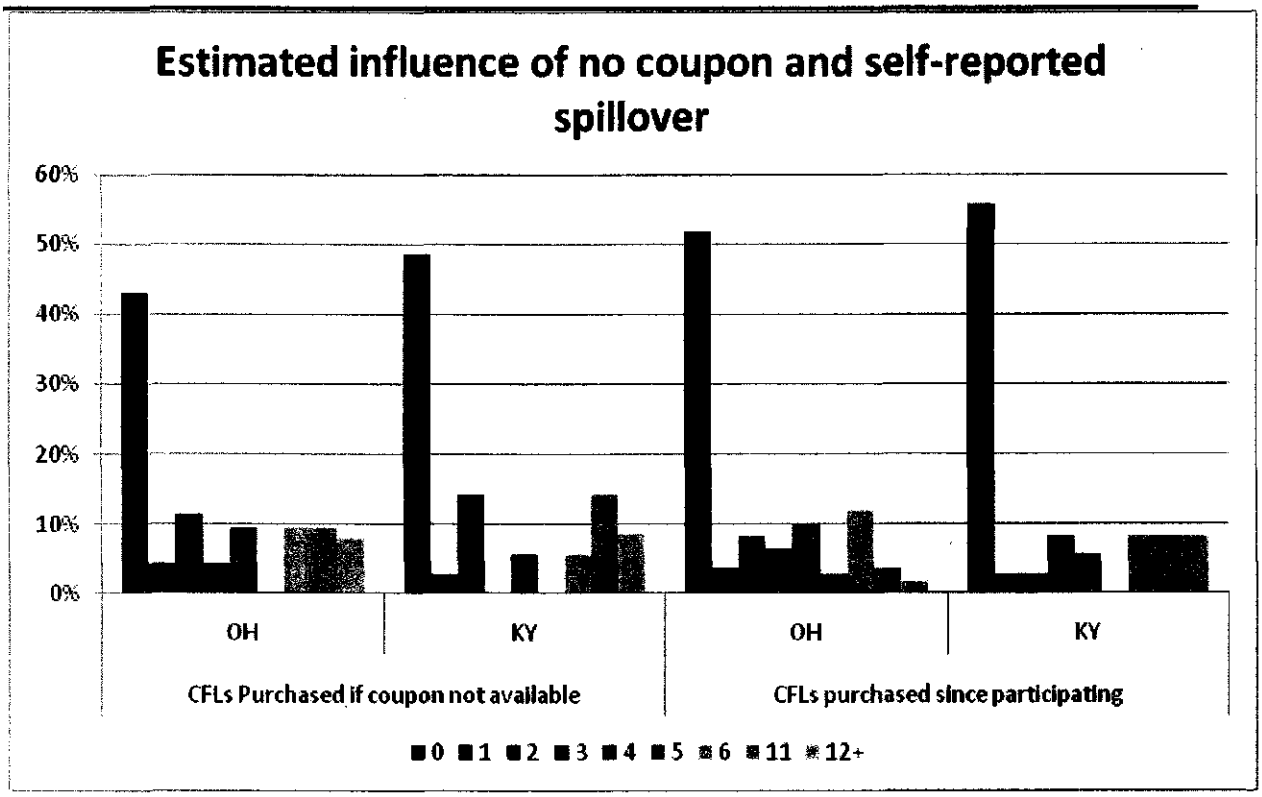


Figure 4. Estimated amount of bulbs bought if no coupon had been available, and additional purchases of CFLs

CFL Usage and Satisfaction

Redeemers were asked if their lighting hours of use had changed after installing CFLs.

Most redeemers have not altered their use behavior after installing their CFLs; that is, 87.7% of redeemers in Ohio and 80% of redeemers in Kentucky reported that they have not changed the hours of use of light fixtures. Of those redeemers who did change their usage in Ohio, equal amounts (6.2%) reported increasing and decreasing their hours of use. In Kentucky 12.5% of redeemers reported decreasing their hours of use while 7.5% said that their hours of use had increased. This data suggests that snap-back is not associated with the Duke Energy CFL purchases - that is, customers are not using their fixtures more now that they are saving money on the use of those fixtures.

Seventy four percent (74%) of redeemers in Ohio and 77.5% of redeemers in Kentucky reported that they have not removed any of the CFLs they installed. Of those redeemers who have removed a CFL that they had installed, over half (59.5%) in Ohio and all (100%) in Kentucky did so because the bulb had burned out.

Bulb removals that were reported were similar to those in the July 2010 report. The number of redeemers who removed at least one program CFL in OH for this report is 26% compared to 16% in the July 2010 report. The reasons for removal were similar to the July 2010 report.

Table 7. Lighting hours of use changes in OH and KY

		OH			KY	
	Increased	Decreased	No change	Increased	Decreased	No change
Fixture hours of use	8	8	114	3	5	32
	6.2%	**6.2%**	**87.7%**	**7.5%**	**12.5%**	**80%**

Table 8. CFLs bought with coupon and subsequently removed

Number of bulbs		0	1	2	3	4	5
OH	N	97	9	14	7	2	2
	%	**74.0%**	**6.9%**	**10.7%**	**5.3%**	**1.5%**	**1.5%**
KY	N	31	5	2	1	1	0
	%	**77.5%**	**12.5%**	**5.0%**	**2.5%**	**2.5%**	**0%**

Table 9. Reasons for removing coupon CFLs

	Reasons for removal	Burned out	Not bright enough	Too slow to start	Did not like the light	Other
OH	N	19	8	3	2	2
	% of all bulbs removed	**55.9%**	**23.5%**	**8.8%**	**5.9%**	**5.9%**
KY	N	9	0	0	0	0
	% of all bulbs removed	**100%**	**0%**	**0%**	**0%**	**0%**

The specific responses for "other" reasons of removal in Ohio were that one redeemer had a dimmer switch and another wanted a three-way bulb.

Previously installed CFLs

Not quite half of redeemers in each state (60.9% in OH and 47.5% in KY) stated they already had at least one CFL installed in their house before purchasing bulbs with Duke Energy coupons, and just over half of redeemers stated they had not already had CFLs installed. Of those redeemers who indicated that they had already installed a CFL, 59.8% had already installed 2, 3, or 4 bulbs, that is while they were already users, the level of use was small, representing only a few sockets per home. That is, these customers had not been previously transformed by other market pressures to be dedicated CFL users.

In the July 2010 report only 44.1% of redeemers indicated they had previously installed CFLs, representing a jump of 15.8% over the year between assessments. The percentage of respondents with 12+ pre-installed CFLs also increased to 17.3% from 8.3%. CFLs continue to penetrate the market with new adopters moving to CFLs and significantly more new adaptors moving to CFLs via Duke Energy programs. Duke is moving the market forward with respects to CFL first us adopters and increased adoption from previous adopters.

Table 10. Pre-installed CFLs

	OH		KY	
	Yes	No	Yes	No
CFLs pre-installed?	75	48	19	21
	60.9%	**39.1%**	**47.5%**	**52.5%**

Table 11. Numbers and percentages of pre-installed CFLs

	Number of bulbs pre-installed	1	2	3	4	5	6	7-11	12+

OH	N	8	13	11	15	2	4	5	13
	% of respondents with pre-installed CFLs (n=75)	10.7%	17.3%	14.7%	20%	2.7%	5.3%	6.7%	17.3%
	% of all surveyed (n=130)	**6.2%**	**10%**	**8.5%**	**11.5%**	**1.5%**	**3.1%**	**3.8%**	**10%**
KY	N	3	7	3	0	1	1	5	5
	% of respondents with pre-installed CFLs (n=19)	15.7%	36.8%	15.8%	0%	5.7%	5.7%	26.3%	26.3%
	% of all surveyed (n=40)	**7.5%**	**17.5%**	**7.5%**	**0%**	**2.5%**	**2.5%**	**12.5%**	**12.5%**

In addition to the number of pre-installed CFLs, redeemers were asked how long they had been using CFLs before using the Duke Energy coupon. Responses included:

- Never purchased until now
- 1 year or less
- 1-2 years
- 2-3 year
- 3-4 years
- 4 or more years

As seen in **Table 15** below, 40.4% of redeemers in OH and 43.2% of redeemers in KY indicate that they have been using CFLs for more than two years and 28.4% of redeemers in Ohio and 21.6% of redeemers in KY indicate that this is their first time using a CFL. This data suggests that CFL saturation is still low within the coupon redeeming population prior to the use of the Duke Energy coupon.

Table 12. Time since first purchase of CFLs in OH and KY

		Never purchased until now	1 year or less	1-2 Years	2-3 Years	3-4 Years	4 or more years
OH		36	11	28	27	10	14
		28.6%	**8.7%**	**22.2%**	**21.4%**	**7.9%**	**11.1%**
KY		8	4	9	8	5	3
		21.6%	**10.8%**	**24.3%**	**21.6%**	**13.5%**	**8.1%**

Redeemers were asked to rate their satisfaction with the CFLs redeemed with their Duke Energy coupon. Ninety eight percent (98.3%) of redeemers in Ohio and 97.2% or redeemers in Kentucky are at least somewhat satisfied and 75.8% of redeemers in Ohio and 72.2% of redeemers in Kentucky of were very satisfied with their CFLs.

Table 13. CFL satisfaction in OH and KY

		Very Satisfied	Somewhat satisfied	Not at all satisfied
OH	N	91	27	2
	%	**75.8%**	**22.5%**	**1.7%**
KY	N	26	9	1
	%	**72.2%**	**25%**	**2.8%**

When CFL satisfaction was tallied for only those redeemers who removed the CFLs purchased with the Duke Energy coupon, 100% (3 of 3) of redeemers in Kentucky and 50% (9 of 18) of redeemers in Ohio indicated they were very satisfied with their Duke Energy CFLs. In Ohio 45% (8 of 18) of redeemers who removed a CFL indicated that they were somewhat satisfied with the CFLs. This is twice the percentage of "somewhat satisfied" responses in the overall survey population and nearly a third of all the "somewhat satisfied" responses in Ohio, indicating that bulb removal, as would be expected, has a negative correlation with CFL satisfaction in Ohio. Time since first installation of CFLs had no impact on satisfaction levels suggesting that long-time users are not more or less satisfied with their CFLs than are new users. Satisfaction levels are unchanged since the July 2010 report.

Future CFL Purchases

Redeemers were asked to consider their future CFL purchases and identify how many CFLs they would expect to purchase in the next year if CFLs were offered at a certain price compared to a standard (incandescent) bulb. The prices offered were:

- The same price as a standard bulb
- $1 more than a standard bulb
- $2 more than a standard bulb
- $3 more than a standard bulb

Redeemers were also asked how many CFLs they would purchase if they were free, but required a mail-in rebate form.

Results are shown for Ohio in Table 16 and for Kentucky in **Table 17** below and illustrated in figures 5 through 7. With CFLs being offered at the same prices as a standard bulb, 94.5% of redeemers in Ohio and 96.9% of redeemers in Kentucky will purchase at least one CFL, and 69.6.% of redeemers in Ohio and 84.4% of redeemers in Kentucky indicated they would purchase four or more. More than 75% of redeemers in Ohio and Kentucky indicated they would purchase at least one CFL bulb if the price per bulb was $1 more. When the price reaches $2 more 50% of redeemers in Ohio and 59.6% of redeemers in Kentucky indicate they would not purchase CFL bulbs. This indicates that customers are expecting CFL prices that are comparable to incandescent lighting.

If the CFL bulbs are free with a rebate form, 84.2% of redeemers in Ohio and 92.9% of redeemers in Kentucky said that they would purchase at least one CFL. Since these percentages are lower than the percentages for CFLs at the same price as incandescent bulbs in both states, this suggests that 10% to 15% of redeemers may be experiencing a barrier other than price when deciding to purchase CFLs.

For example, some customers may not be at all interested in purchasing CFLs due to size, slow illumination, aesthetics or the quality of light and would not purchase CFLs regardless of price or price difference. In addition, for some of these redeemers the hassle of the rebate process may outweigh other advantages of purchasing CFLs; for example, 10 (9.9%) redeemers in Ohio and 2 (7.4%) redeemers in Kentucky stated they would purchase CFLs at a price equal to standard bulbs but would not obtain them if they were free through the use of a rebate.

All percentages were similar to the July 2010 report except for the number of redeemers who would purchase zero CFLs if the price was $3 more than incandescent bulbs. This number is 12% higher than the 2010 report. (70.3% compared to 58.3%).

Table 14. Hypothetical CFL buying habits in Ohio under 4 different pricing scenarios

	Number of bulbs	0	1-2	3	4	5	6	7-11	12+
They were the same price as a standard bulb?	N	6	20	5	11	7	15	13	25
	%	5.9%	19.6%	4.9%	10.8%	6.9%	14.7%	12.7%	24.5%
They were $1.00 more than standard bulbs?	N	22	11	8	14	6	9	11	11
	%	23.9%	12.0%	8.7%	15.2%	6.5%	9.8%	12.0%	12.0%
They were $2.00 more than standard bulbs?	N	45	14	7	7	6	5	1	5
	%	50.0%	15.6%	7.8%	7.8%	6.7%	5.6%	1.1%	5.6%
They were $3.00 more than standard bulbs?	N	64	6	6	3	3	3	1	5
	%	70.3%	6.6%	6.6%	3.3%	3.3%	3.3%	1.1%	5.5%
They were free but you had to mail in a rebate form to get your money back?	N	16	12	7	10	6	11	12	27
	%	15.8%	11.9%	6.9%	9.9%	5.9%	10.9%	11.9%	26.7%

Table 15. Hypothetical CFL buying habits *in* Kentucky under 4 different buying scenarios

		0	1-2	3	4	5	6	7-11	12+
They were the same price as a standard bulb?	N	1	3	1	7	5	3	5	7
	%	3.1%	9.4%	3.1%	21.9%	15.6%	9.4%	15.6%	21.9%
They were $1.00 more than standard bulbs?	N	7	3	1	3	3	5	6	2
	%	23.3%	10.0%	3.3%	10.0%	10.0%	16.7%	20.0%	6.7%
They were $2.00 more than standard bulbs?	N	16	1	2	2	2	2	2	0
	%	59.3%	3.7%	7.4%	7.4%	7.4%	7.4%	7.4%	0.0%
They were $3.00 more than standard	N	18	3	2	1	0	1	2	0
	%	66.7%	11.1%	7.4%	3.7%	0.0%	3.7%	7.4%	0.0%

bulbs?									
They were free but you had to mail in a rebate form to get your money back?	N	2	0	3	2	3	4	5	10
	%	7.1%	0.0%	10.7%	7.1%	10.7%	14.3%	17.9%	34.5%

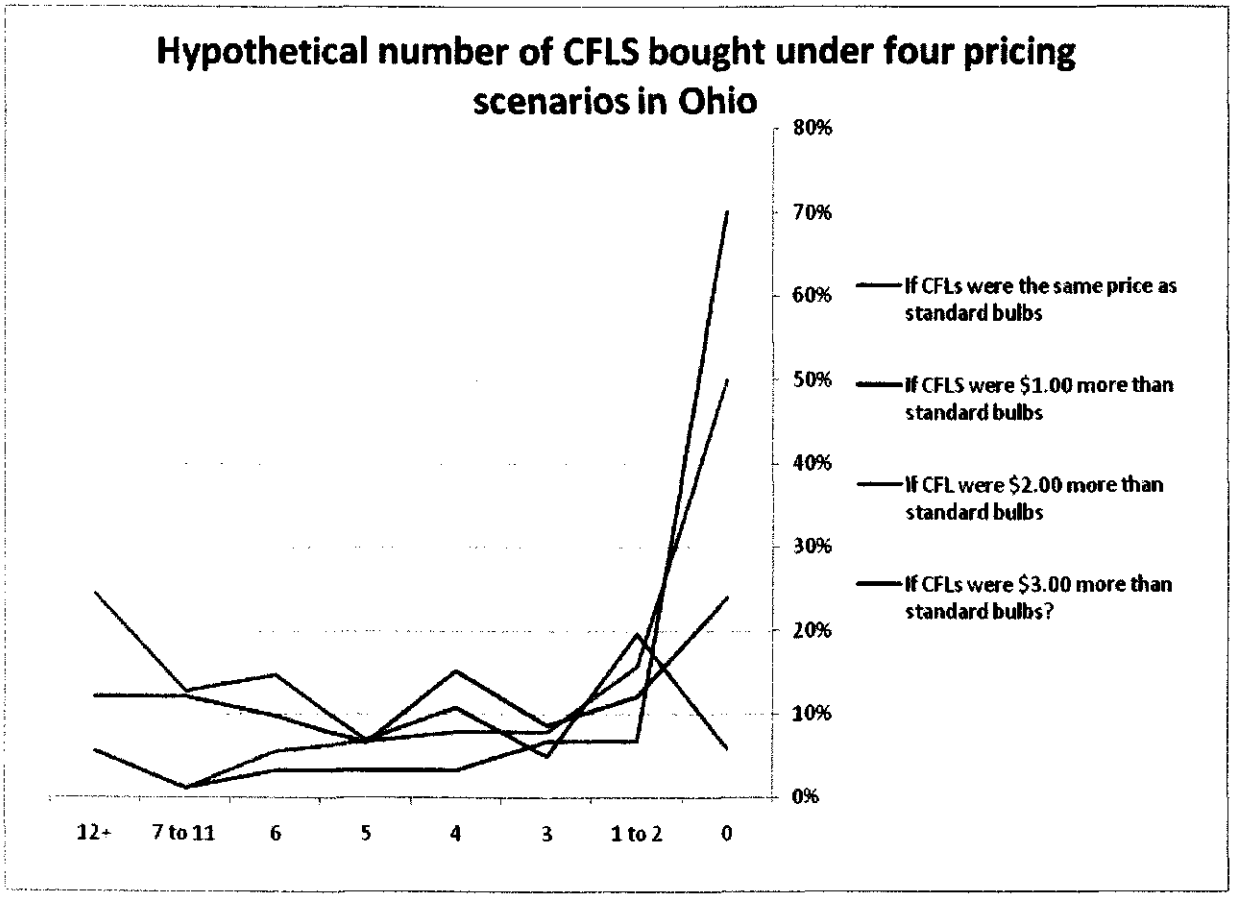


Figure 5. Hypothetical CFL pricing scenarios in Ohio

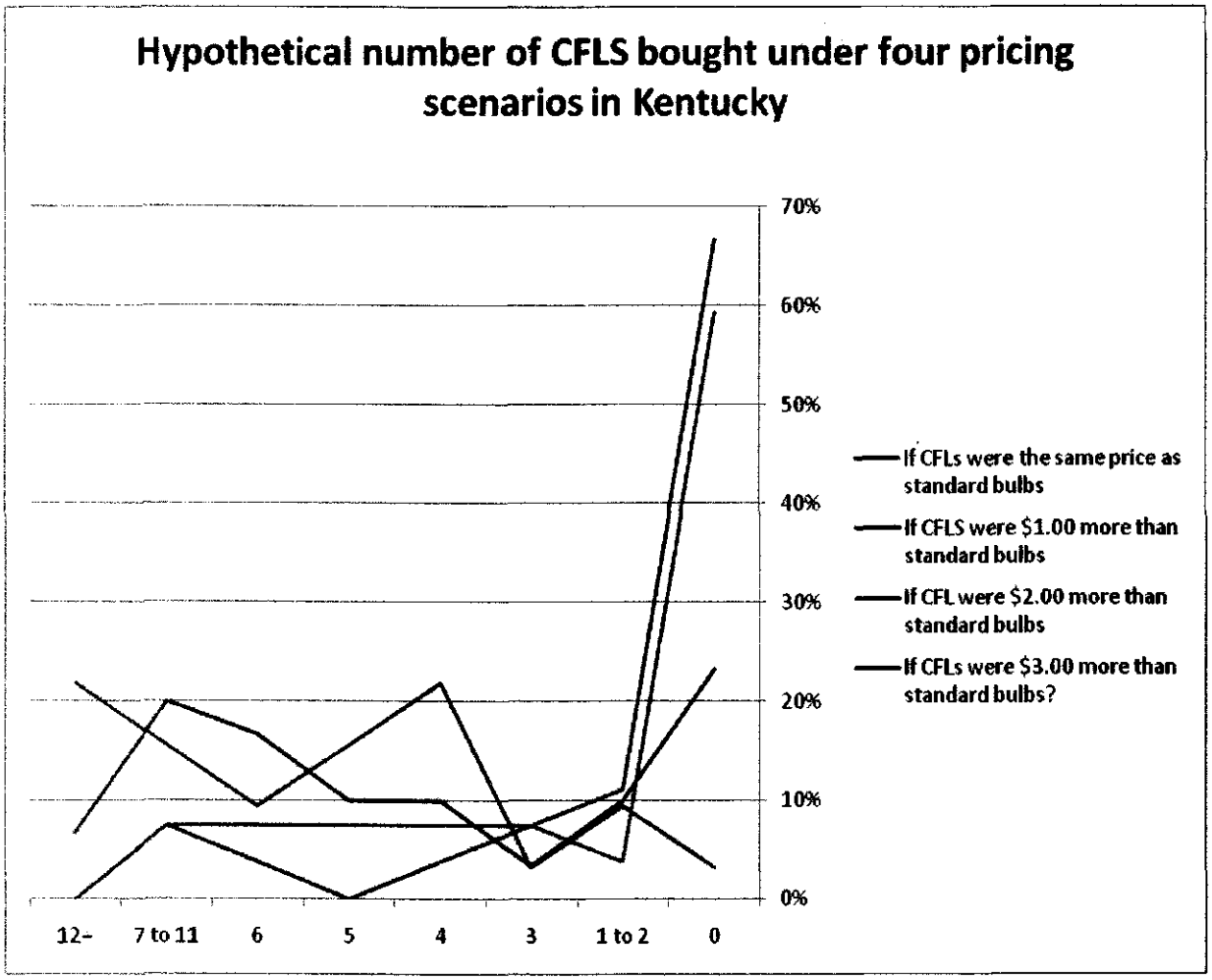


Figure 6. Hypothetical pricing scenarios in Kentucky

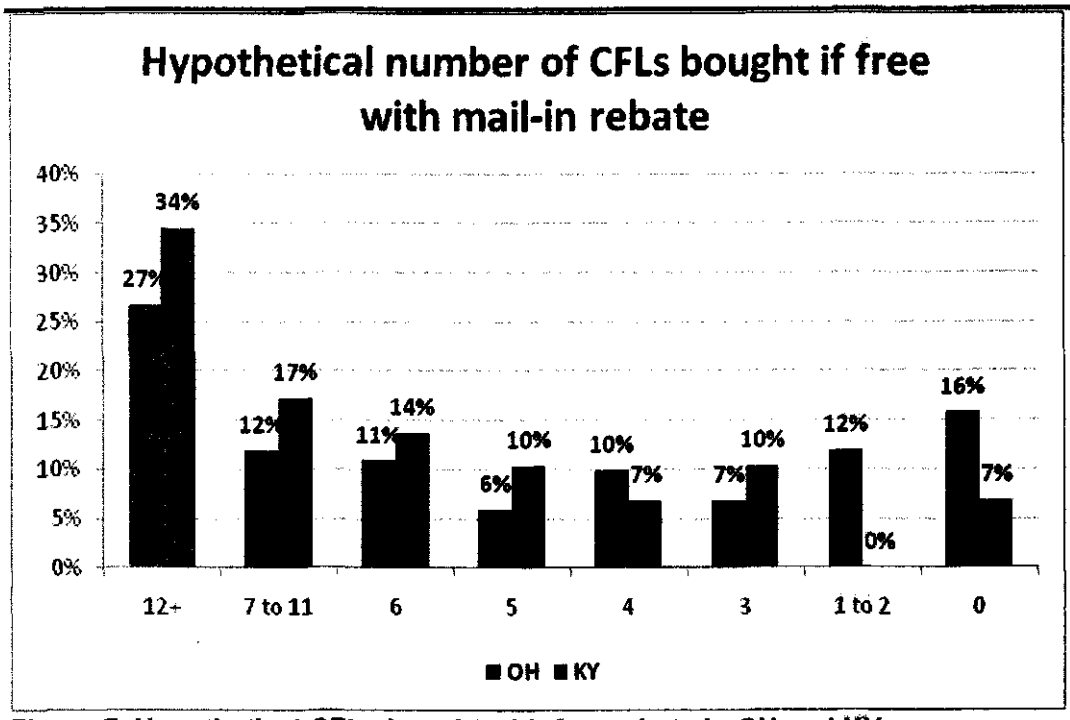


Figure 7. Hypothetical CFLs bought with free rebate in OH and KY

Influence of program CFLs on redeemer confidence and future use of CFLs
Redeemers were asked a series of five questions to determine the influence of program CFLs on their confidence in CFLs and their likelihood of buying CFLs in the future.

The specific categories to rate were:

- Confidence to use CFLs in the future
- Coupon's influence to in choosing CFLs in the future
- Confidence in performance of CFLs bought with the coupon to meet expectations
- Likelihood of buying CFLs in the future
- Likelihood to use a CFL if you had to change a lightbulb

Each category had five ratings for redeemers to choose from:

- Much more likely/confident/better
- More likely/confident/better
- About the same
- Less likely/confident or worse
- Much less likely confident or worse

Results are summarized in Figures 8 and 9 below. OH and KY results were combined to provide a more reliable sample size for new adopters.

Overall, new adopters rated their confidence in CFLs, influence of the program, and performance of CFLs higher than redeemers who had used CFLs previously. However, when combining the ratings of "about the same" or higher, new adopters and previous adopters had very similar total percentages in all

categories. This suggests that the program has a positive influence on the confidence level of new adopters of CFLs and does not negatively affect the opinions of previous adopters.

Figure 9 shows that new adopters and previous adopters are equally as likely to purchase CFLs in the future, however, 8% more (37% compared to 29%) of previous adopters are likely to replace a failed bulb with a CFL (rather than a standard bulb) than new adopters. That is, new adopters are still testing the waters, while past users are more comfortable with continued use and may have a higher degree of acceptance that some CFL bulbs will fail, than non-previous adopters. This suggests that while previous adopters may have a higher freeridership rating, they are also more likely to deliver savings via higher installation and continued use rates.

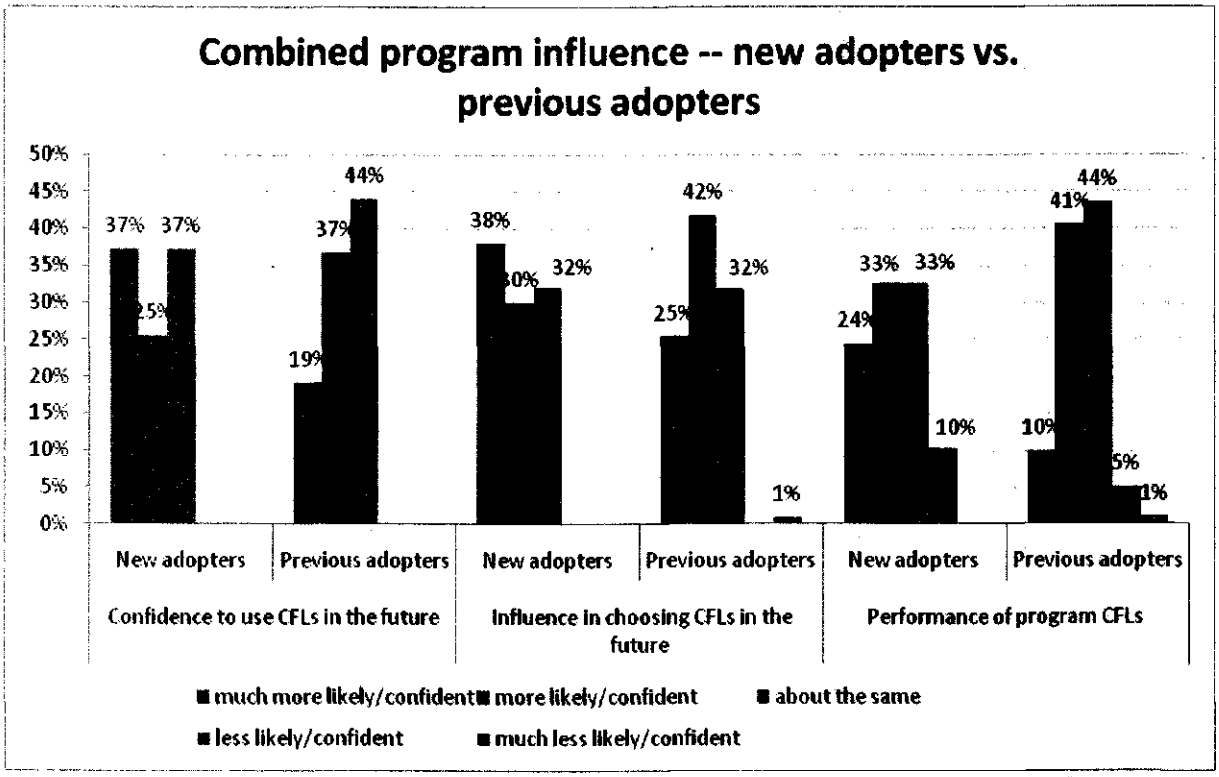


Figure 8. Forward looking influence of program in OH and KY combined. N=110 for previous adopters. N=50 for new adopters.

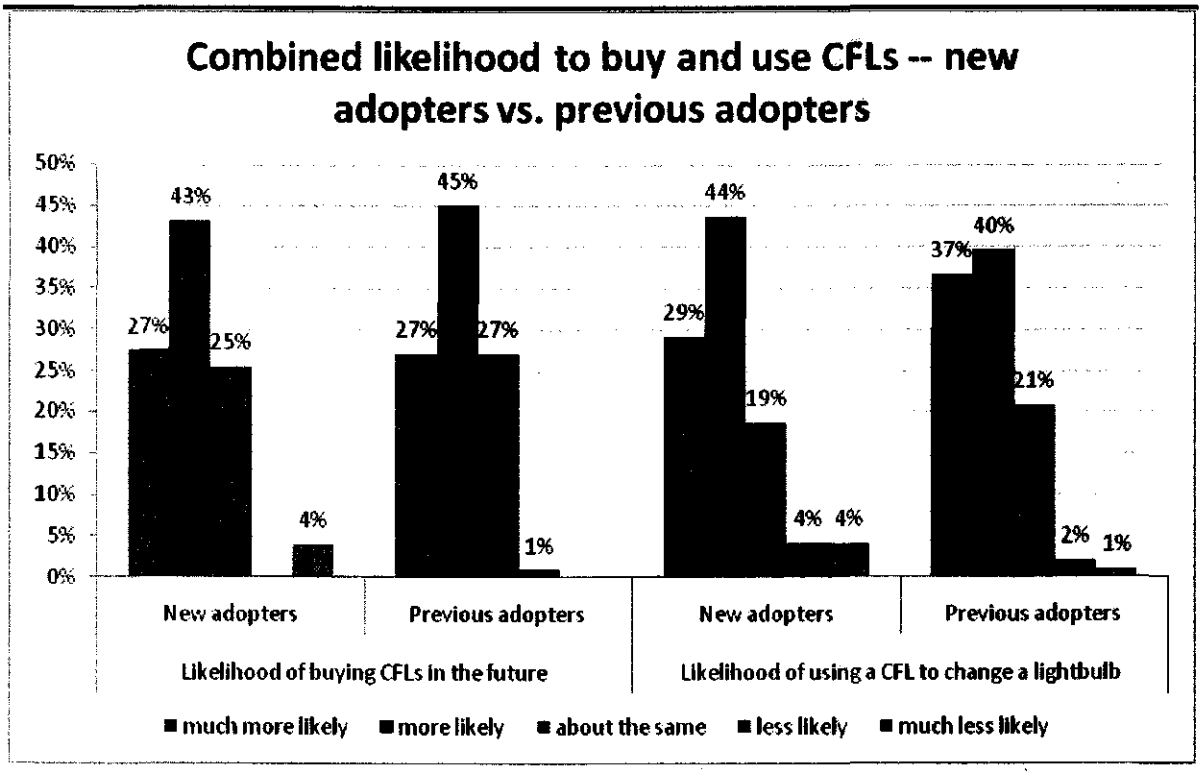


Figure 9. Forward-looking influence of program on buying and replacing habits in OH and KY combined. N=110 for previous adopters. N=50 for new adopters.

Duke Energy

Survey T. Est
123456 Does This Layout Work Rd.
Seems Like It Is, OK 55555

Dear Customer,

Duke Energy is continuously trying to improve our services for you. To help us improve the **Compact Fluorescent Light bulb** program, we would like your input. Please let us know what you think about the compact fluorescent light bulbs (CFLs) you purchased through our coupon promotion. Some examples of CFLs are in the pictures below. If you have any questions, please contact Duke Energy at mresearch *a* duke-energy.com.

WE WOULD LIKE YOUR OPINION ABOUT OUR COMPACT FLUORESCENT LIGHT BULB (CFL) COUPON PROGRAM. PLEASE FILL IN THE CIRCLES COMPLETELY USING BLUE OR BLACK INK.

Do you recall receiving Compact Fluorescent Light bulb (CFL) coupons from Duke Energy? ○ Yes ○ No

Did you give away any of your coupons to someone else to use? ○ Yes ○ No

Did you use at least one coupon yourself? ○ Yes – Continue this survey ○ No – Thank you. Please return survey.

How influential were the following in your decision to purchase CFL(s)?

	Very Influential	Somewhat Influential	Not at all Influential
The coupon from Duke Energy	○	○	○
In-store CFL displays and signs	○	○	○
Non-in-store advertising (TV, radio, newspaper, etc.)	○	○	○
Sales associates at the store	○	○	○
CFL Brand	○	○	○
Other advertising	○	○	○
Friends or family	○	○	○

At which store did you purchase your CFL bulbs using the Duke Energy coupons? _____

Did you purchase any of the following items at the same time you purchased the CFLs with the Duke Energy coupons? Mark all that apply.

○ Wall or ceiling insulation ○ Faucet aerators ○ Low flow showerhead ○ Weatherstripping

○ Caulking ○ Electric wall outlet gaskets ○ Programmable thermostat ○ None of these

In this section of the survey, we would like to know how you have used the CFL packs you purchased with the coupons.

	0	1	2	3	4	5	6	7-11	12+
How many CFL bulbs did you purchase in TOTAL with the Duke Energy coupon(s)?		○	○	○	○	○	○	○	○
How many CFL bulbs would you have bought if you had not had the Duke Energy coupon(s)?	○	○	○	○	○	○	○	○	○
How many CFL bulbs have you since purchased without Duke Energy coupons?	○	○	○	○	○	○	○	○	○

Of the CFLs you bought with the Duke Energy coupons:

	0	1	2	3	4	5	6	7-11	12+
How many CFLs are now installed?	○	○	○	○	○	○	○	○	○

For each CFL purchased with coupons that is now installed, please write in WHERE each CFL was installed, WHAT wattage the CFL is, WHAT wattage the old bulb was, and on average, HOW MANY HOURS you use that light each day.

	WHERE CFL INSTALLED	CFL WATTAGE	OLD BULB WATTAGE	HOW MUCH LIGHT IS USED (Hours Each Day)
Example	Living Room Floor Lamp	13Watt CFL	60Watt Incandescent	6 Hours Per Day (average)
Example	Hallway Ceiling Fixture	15Watt CFL	20Watt CFL	1 Hour Per Day (average)
Bulb 1				
Bulb 2				
Bulb 3				
Bulb 4				
Bulb 5				
Bulb 6				
Bulb 7				
Bulb 8				
Bulb 9				
Bulb 10				
Bulb 11				
Bulb 12				
Bulb 13				
Bulb 14				
Bulb 15				

Have you changed the hours of use of any fixture in which you installed the CFLs? ○ Yes ○ No

If you answered yes, how did your average usage change? ○ Increased usage ○ Decreased usage

Have you removed any of the CFLs you installed? ○ Yes ○ No

	1	2	3	4	5	6	7-11	12+
If yes, how many did you remove?	○	○	○	○	○	○	○	○

Why did you remove them?

○ Not bright enough ○ Did not like the light ○ Too slow to start
○ Burned out ○ Not working properly ○ Other

If other, please specify:_____

Did you have any CFLs installed in light sockets in your house before you bought the CFLs with the Duke Energy coupon? ○ Yes ○ No

	1	2	3	4	5	6	7-11	12+
If yes, about how many were already installed?	○	○	○	○	○	○	○	○

How long have you been using CFL light bulbs?

○ Never purchased a CFL until now ○ 1 year or less ○ 1 to 2 years ○ 2 to 3 years
○ 3 to 4 years ○ 4 or more years

	Very Satisfied	Somewhat Satisfied	Not at all Satisfied
Overall, how satisfied are you with the Duke discounted CFLs?	○	○	○

	Often	Sometimes	Never
Do you use the Duke Energy Website?	○	○	○

Have you added any major electrical appliances to your home in the past year? ○ Yes ○ No

Are you aware of the ENERGY STAR label? ○ Yes ○ No

Do you typically look for the ENERGY STAR label when purchasing an appliance? ○ Yes ○ No

Do you typically buy appliances with the ENERGY STAR label? ○ Yes ○ Some of the time ○ Never

CFL Purchasing

Considering future CFL purchases, how many CFL bulbs would you purchase in the next year if...

	0	1-2	3	4	5	6	7-11	12+
They were the same price as a standard bulb?	○	○	○	○	○	○	○	○
They were $1.00 more than standard bulbs?	○	○	○	○	○	○	○	○
They were $2.00 more than standard bulbs?	○	○	○	○	○	○	○	○
They were $3.00 more than standard bulbs?	○	○	○	○	○	○	○	○
They were free but you had to mail in a rebate form to get your money back?	○	○	○	○	○	○	○	○

General Information About Your Home

How would you best describe the type of home in which you live?

○ Detached single-family ○ Townhouse ○ Condominium ○ Duplex 2-family

○ Apartment ○ Manufactured home ○ Multi-Family (3 or more units)

In what year was your home built?

○ 1959 or before ○ 1960 - 1979 ○ 1980 – 1989 ○ 1990 - 1997

○ 1998 – 2000 ○ 2001 – 2007 ○ 2008 or later

What is the approximate square footage (heated area) of your home?

○ Less than 500 ○ 500-999 ○ 1,000-1,499 ○ 1,500-1,999

○ 2,000-2,499 ○ 2,500-2,999 ○ 3,000-3,499 ○ 3,500-3,999

○ 4,000 or more ○ Don't know

What range best describes your total annual household income?

○ Less than $25,000 ○ $25,000 to $49,999 ○ $50,000-$74,999 ○ $75,000-$100,000

○ Over $100,000 ○ Don't know ○ Prefer not to answer

How many people live in your home?

○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 or more

Do you own or rent your home?

○ Own ○ Rent

Primary heating fuel? ○ Electric ○ Gas ○ Oil ○ Propane ○ Other ○ None

Type of heating system?

○ Central furnace ○ Electric baseboard ○ Heat pump

○ Geo-thermal heat pump ○ Hot water or steam boiler ○ Other ○ Do not have

Age of heating system in years?

○ 0-4 ○ 5-9 ○ 10-14

○ 15-19 ○ >19 ○ Don't know ○ Do not have

Primary cooling fuel? ○ Electric ○ Gas ○ Oil ○ Propane ○ Other ○ None

Type of cooling system?

○ Central air conditioner ○ Window/Room unit air conditioner ○ Heat pump (for cooling)

○ Geo-thermal heat pump ○ Other ○ No cooling system

Age of cooling system in years?

○ 0-4 ○ 5-9 ○ 10-14

○ 15-19 ○ >19 ○ Don't know ○ Do not have

HAVE A CHANCE TO PARTICIPATE IN THE DUKE ENERGY LIGHTING STUDY

Would you be interested in participating in a lighting study in July and August 2009?

A Duke Energy representative would place small lighting monitors on 4 or 5 light fixtures which would remain in place for 2 to 3 weeks. The monitors are smaller than the size of a bar of soap and help us measure how often lights are turned on and off during the week. The first 100 returned surveys indicating interest will be contacted. Eligible customers that are selected will receive $50 for participating.

If yes, you may receive a follow-up phone call about this lighting study in July.

○ **Yes, I am interested in participating. My phone number is: _____.**

○ **My address on the front page of this survey is correct.**

○ **My address is:**

_____

○ No, I am not interested in participating

THANK YOU FOR YOUR RESPONSES

Final Report

Ohio Residential Smart $aver CFL Program

Results of a Process and Impact Evaluation

June 29, 2010

Prepared for

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TECMARKET Works

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Tables

Figures

This evaluation was conducted by TecMarket Works and BuildingMetrics with support from Duke Energy.

The process evaluation was conducted by TecMarket Works. The impact evaluation was conducted by Duke Energy with BuildingMetrics supervision, review and approval. The CFL surveys were developed by TecMarket Works and Duke Energy. The survey fielding was conducted by Duke Energy with oversight by TecMarket Works. The survey data analysis was supervised, reviewed and approved by TecMarket Works.

TecMarket Works and BuildingMetrics are independent evaluation firms providing energy efficiency program evaluation services to government and utility clients.

Executive Summary

This report presents the findings of the Residential Smart Saver® Compact Fluorescent Lightbulb (CFL) Program for Duke Energy from October 2008 through September 2009. Three campaigns took place during this time – a "Lowe's campaign", a "Walmart campaign", and a "GE campaign", all featuring mailed coupons. This report reviews the program's customer satisfaction, demographics, CFL use, and the energy savings from the CFLs purchased through the program. The evaluation is separated into the two components: a process evaluation, and an energy impact analysis: To support this analysis two surveys were conducted – a coupon redeemer survey, and a coupon non redeemer survey. In addition, interviews were conducted of Duke Energy program managers, CFL bulb retailers, and manufacturers that offered CFL coupons. Finally, for the impact evaluation, a lighting logger study was conducted with customers who redeemed CFL coupons to estimate lighting usage in their home.

Methodology

To conduct the energy impact analysis this study combined the information from two data collection approaches that together allowed the estimation of saved energy. In addition, this study conducted interviews with program managers and retail store managers that when combined with customer surveys allowed for the assessment of the operations of the program.

The kilowatt hour savings were calculated using the data obtained from the lighting logger study performed on homes in the targeted areas served by the program, which provided average hours of use for each room type in which the CFLs were installed. These values were used to inform the customer responses to the CFL coupon redeemer survey which indicated the room type, wattage of lamp installed, wattage of lamp replaced, and customer-estimated hours of use.

Two surveys were sent to customers: a coupon redeemer survey sent to customers who redeemed Duke Energy coupons for CFL bulbs, and a coupon non redeemer survey sent to customers who received but did not redeem coupons for CFL bulbs. The coupon redeemer survey asked customers to provide information regarding their purchase of CFL bulbs, their experience with CFL bulbs, and their satisfaction with CFL bulbs. Customers who did not redeem CFL coupons were sent a coupon non-redeemer survey. This survey also asked customers questions regarding their purchase of CFL bulbs, why they did not redeem Duke Energy coupons, and their experience and satisfaction with CFL bulbs. The surveys can be found in the appendices of this report.

Program operations were evaluated through an in-depth interview with two program managers and five retail store managers.

Summary of Findings and Recommendations

An overview of the key findings and recommendations identified through this evaluation is presented below.

Findings

1. Duke Energy's CFL coupons are very popular with retailers, boosting sales 500 to 1,000 percent over typical sales, in some cases causing stores to move product from non-Duke Energy territories and providing substitutions and back orders. This is a substantial increase in sales and reflects well on Duke Energy and on their marketing efforts and promotional initiatives. Duke managers report large movements of CFLs in all Duke territory stores carrying the GE brand with retailers reporting sales as fast as they can stock the covered bulbs.

2. Discount coupons are recently experiencing diminishing returns as far as reaching new customers to redeem the price reduction the coupons. Strategies are now being implemented to reach non-coupon users. Additional targeting and motivational appeals at younger and more mobile customers who are less likely to redeem coupons is needed if the use of discount coupons is maintained to increase redemption from this group. However, Duke Energy has moved to a no cost coupon for a free 6 pack of CFLs that has increased sales of CFLs to the point where the market is having trouble stocking bulbs and retailers are asking for advance notice of coupon distribution to enable them to have enough stock in the stores. Duke Energy managers report that redemption rates are running between 12% and 17% compared to about 3% with the price reduction coupons.

3. The strategy of using individual customer-coded coupons allows Duke to focus on accurately tracking customer purchases rather than reconciling participation and sales counts with retailers. The move to customer-specific coupons also allow Duke Energy to move away from a store-focus program to a customer-targeted program, a more efficient method of operation that can expand and contract as needed by including or not including customers in direct mail targeting. The method also allows for strategic geo-expansion of the program by targeting more areas rather than increasing coordination with specific stores. This also allows Duke Energy the flexibility of moving between a discount coupon and a free bulb coupon to match the energy and cost effectiveness goals. This method has also allowed Duke Energy to identify a few (less than 10) customers who have copied the coupon in order to obtain more than the maximum number of free bulbs.

4. Home Depot does not carry the partnered brand resulting in a large CFL retailer not being allowed to participate in the program. However, by moving to a manufacture's coupon Duke is able to take the retail store out of the equation, letting the customer to go more stores that carry the manufactures brand. Duke Energy has also allowed customers to acquire the CFLs over the web if they cannot or are unable to go to one of the retail outlets, increasing exposure and adoption rates. In the web process Duke Energy can validate their status as a Duke Energy customer and verify that they are eligible for the CFLs. This allows Duke Energy to mail only the number of bulbs that the customer is eligible to receive (up to 15 bulbs) by real-time database verification to see if they have redeemed a coupon in the past.

5. Retailers report that the coupons significantly affect sales and a discontinuation of the program would result in much fewer CFLs purchased as well as a significantly lower focus on CFL sales by the retailer.

6. Retailers report they need additional lead time to acquire additional stock because of the higher sales volumes that have occurred after Duke Energy's coupons were distributed. This is a problem growing out of the success of the effort. That is, the effort was successful enough that the retailers report needing extra time to obtain inventory from their non-Duke Energy territory stores to support the increased sales. However, because of the increased demand and the strong customer acceptance, retailers report that coupons should have longer duration periods to allow them to not expire so quickly and allow participants more time to redeem their coupons. GE reported sending out 1.5 million postcards to Duke Energy's customers to let them know that they could still redeem their coupons after the expiration date to compensate for lack of stock.

Energy Savings Summary

Gross Energy Savings Calculations

Past evaluations have indicated that self-reported hours of use tend to over-estimate estimated savings by over-estimating typical hours of use. As a result, in order to reliably estimate energy impacts it was necessary to calibrate the participants' reported hours of use (from the participant survey) to the results of the logger study that recorded the actual hours of use. To establish actual hours of use for the surveyed population the evaluation team regressed the data from the lighting logger study, to the participant's estimated hours of use responses to the survey questions. This allowed the impact estimate to be based on the adjusted hours of use, times the difference in wattage between the bulb replaced and the bulb installed as reported by the participants. From this calculation a gross yearly energy savings of 29,068 kWh/year was estimated for those 200 customers who installed a total of 561 bulbs and who completed the participant survey, or a net program-induced savings of 44.75 kWh per bulb

Free Riders and Free Drivers

From the survey results, it was determined that 40.74% of CFL purchases made were due to free riders[1], while 25.56% of purchases made were due to free drivers[2] for a net-to gross-adjustment factor of 15.18% excluding additional market effects caused by the program beyond the participant purchases[3].

Total Program Net Energy Savings Calculations

Program impacts are presented in the Impact Evaluation Summary Table below.

Table 1. Impact Evaluation Summary Table

[1] Free rider: someone who would have taken the same action without the program's influence.
[2] Free driver: someone who takes additional actions as a result of the influence of the program.
[3] As retailers focus on stocking and displaying more CFL products as a result of the program's marketing push, additional sales are generated by non-participating shoppers. This study excludes the savings acquired by non-participating customers as a result of the way in which the program influenced total CFL sales.

Metric	Result
Number of Bulbs	561
Gross kW per bulb	0.06 kw
Gross kWh per bulb	52.76 kwh
Gross therms per bulb	N/A
Freeridership rate	40.74%
Spillover rate	25.56%
Self Selection and False Response rate	N/A
Total Discounting to be applied to Gross values	15.18%
Net peak kW per bulb	**0.04 kW**
Net annual kWh per bulb	**44.75kWh**
Net therms per participant	N/A
Measure Life	5 years*
Effective useful life net savings per bulb	223.75kWh

* While the advertised expected life of the installed CFLs is greater (10 years), recent research in California has indicated that CFL bulbs installed in typical rooms have switching behaviors that erode about half the advertized effective useful life. The adjustment approach for reducing the effective useful life to 5 years is presented in the Appendix entitled: Effective Useful Life Adjustment Factor for Installed CFLs.

Table 2 shows the location where CFLs purchased with coupons were installed in participants' homes, the average wattage of the bulb replaced, and the self-reported average number of hours the CFL is turned on each day as reported on the CFL coupon redeemer survey. Most bulbs were installed in either the living room, bed room, kitchen or "other" rooms. CFLs installed here typically replaced a 50-60W bulb, In addition, CFLs purchased with coupons could include 13W, 20W, and/or 26W bulbs bringing the typical wattage replaced to below 50 watts in a number of rooms. The kitchen, den, laundry room, and living room lights were turned on for a longer period of time than the lights in many other room types.

Table 2. 2009 CFL Redeemer Survey: Location of Purchased Bulbs, n=200

	Number of Replacements by Room	Percent of Respondents Replacing at Least One Bulb in This Room	Average Wattage of Bulb Replaced	Average Self Reported Hours Bulb Used
Living Room	184	40.0%	50.65	3.62
Bedroom	164	36.0%	48.71	2.13
Kitchen	115	26.0%	47.83	4.73
Other	83	27.5%	52.94	2.31
Basement	79	18.0%	62.99	3.16
Bathroom	74	16.0%	45.01	2.27
Hallway	51	15.0%	51.08	2.36
Dining Room	31	7.5%	60.40	1.76
Garage	19	6.0%	70.37	1.29
Office	17	5.5%	47.94	3.29
Laundry Room	12	5.5%	56.67	3.98
Den	12	5.0%	66.25	4.00
Entryway	9	2.0%	60.00	1.17
Stairway	3	1.0%	60.00	3.50
Foyer	2	1.0%	30.00	3.50

Recommendations

TecMarket Works and Building Metrics offer the following recommendations for the Smart $aver® CFL Program.

1. Consider conducting light logger studies near the spring and fall equinox to limit the effect of daylength on the logger study results.

2. Consider conducting light logger studies at different times of the year to observe the daylight effect (more expensive).

3. Continue use of targeted marketing efforts to identify customers most likely to purchase CFLs during the specific promotion or campaign. 2008 targeted messaging analysis shows that targeting messages to customers based on likelihood of adoption is successful in providing lift to populations that were not as likely to purchase CFLs. (Note: during the drafting of this report Duke Energy has continued testing motivational message content and redemption rates and reports that they have narrowed the messaging to energy and environmental appeals that experience the higher adoption and redemption rates and have moved to the use of free product coupons that together are substantially increasing redemption rates for CFLs.)

4. Savings for typical CFL bulbs may decrease over time as more customers adopt CFLs and continue to install bulbs in lower use sockets and fixtures. Consider transitioning the CFL program to incorporate other types of CFL offers, such as specialty bulbs (candelabras, torchieres, outdoor, etc.), LEDs, and other emerging technologies as they become cost effective. (Evaluation Review Follow-Up Note: Duke Energy reports that they are currently examining the inclusion of specialty bulbs to understand their potential with both past CFL redeemers and previous purchasers of CFLs as well as approaches for reaching new customers with specialty bulb appeals and offers. In addition, TecMarket Works is currently assessing the market for CFLs and will address the potential for specialty bulbs in the CFL potentials report to be delivered in July 2010. Duke Energy also reports that they continue to test ways to increase CFL use via toll-free number and internet exposure as well as direct marketing.)

5. Consider incorporating a market effects study to identify ways to transition the program moving forward as traditional CFLs are phased out in the coming years, as shown in Table 3 below.

Table 3. EISA Schedule for General Service Incandescent[4]

Current Wattage	Rated Lumen Ranges	Maximum Rated Wattage	Minimum Rated Lifetime	Effective Date (Manufactured on or after)
100	1490-2600	72	1,000 hours	1/1/2012
75	1050-1489	53	1,000 hours	1/1/2013
60	750-1049	43	1,000 hours	1/1/2014
40	310-749	29	1,000 hours	1/1/2014

[4] Source: http://www1.eere.energy.gov/buildings/appliance_standards/residential/pdfs/lighting_legislation_fact_sheet_03_13_08.pdf

6. Consider coupling CFL efforts with other energy saving measures and/or programs. Customers did not buy many other energy efficiency items in addition to the CFLs when making their CFL purchases. Program managers could leverage both redeemer and non redeemers' awareness of ENERGY STAR to incorporate other energy saving items and/or encourage customers take other energy saving actions at the same time they are purchasing CFLs. Coupon redeemers purchased other energy saving measures (caulking, weather stripping, low-flow showerhead) in small quantities and might be interested in other simple energy saving measures if they were co-marketed with a CFL offer. Both redeemers and non redeemers may be interested in such measures as ENERGY STAR appliances, or other Duke Energy programs offering energy efficient measures such as HVAC or home audits. (Evaluation Review Follow-Up Note: Duke Energy reports that they have already started coordinating program services to include multi-product appeals and exposure in their small business programs, the Home Energy House Call program, neighborhood canvassing, and are considering other programs that can act as aggregation efforts to expose customers to multiple measures.)

7. Non coupon redeemers are generally not influenced by receiving Duke Energy coupons to purchase CFLs elsewhere, however, the price of CFLs is a factor for these customers. Consider additional marketing strategies for these customers that incorporate the Duke reduced price of CFLs, recommendations of friends and family, and other types of advertising appeals. These customers were more influenced by in-store advertising than the coupon redeemers, so other types of offers for CFL savings, such as point of purchase offers, may appeal to these customers. (Evaluation Review Follow-Up Note: Duke Energy reports that they have started these efforts with property management programs, business reply cards and web campaigns.)

CFL Marketing Efforts

Duke Energy has been using experimental design techniques for several years to carefully track and understand the relative productivity of their coupons and other consumer offers. For example, in 2008 depending on the target (coupon redeemers, CFL adopters, or non-adopters) Duke Energy found that by experimentally varying the message used in coupons, message productivity could be increased 15 to 200%.

This section presents short descriptions of the CFL campaigns and offers being promoted by Duke Energy in 2010. All of the offers provide Duke Energy customers an opportunity to 'opt-in' for CFL bulbs. Each campaign offer provides a new channel and will help Duke Energy to reach coupon non-redeemers and customers who qualify for CFLs.

1. BRC (Business Reply Card) – Duke Energy will mail a business reply card to eligible customers to 'opt-in' and request a free 6 pack of CFLs to ship directly to their homes at

no additional cost. Each BRC contains a unique barcode to track requests to a Duke Energy account number. BRCs are returned back to Duke Energy to scan and a file will be created to send to a 3rd party vendor for fulfillment. The vendor will ship the kits and upload the results to the EE database for impacts.

a. The first round of BRCs will be mailed to customers in the Carolinas and Ohio beginning June 1, 2010.
b. The second round of BRCs will be mailed to customers in the Carolinas and Ohio beginning July 14, 2010.
c. The third round of BRCs will be mailed to customers in Indiana (once approved) beginning (tentatively) in September 2010.

2. IVR/WEB/OLS (CFL offer) – Duke Energy will provide eligible customers three new channels to request free CFLs to be shipped directly to their homes at no additional cost. Customers can choose the channel they prefer to request the bulbs.

a. The IVR will consist of a toll free number for Duke Energy customers to call in to authenticate their account(s) to see how many bulbs they qualify for. Customers acknowledge the order and Duke Energy processes the file to be fulfilled by a 3rd party vendor. The file will go directly to the vendor (processed daily) to speed up the ordering process.
b. The WEB will consist of screenshots walking a customer through the ordering process. Customers will enter their account number and/or phone # plus last four digits of their social security number to check eligibility. Customers will immediately see how many bulbs they qualify for, accept or decline the order, and proceed to check out.
c. OLS customers (new and existing) will receive a 'pop up' upon logging into OLS stating that they qualify for CFLs. They can choose to accept or decline. The same ordering process is identical to the WEB stated above. If an OLS customer declines upon logging into OLS they will only see a "promo" box upon entering OLS during their next visit.
    i. Duke Energy will do a 'slow' rollout during the initial launch (scheduled for September 2010) of the program utilizing low cost/ no cost channels to gain experience with the CFL offer. Orders will ship weekly with results uploaded by the vendor.

3. Property Manager – Duke Energy is partnering with NC and Ohio property managers to ship 'bulk' CFLs to rental properties. Duke Energy will pay for the bulbs and the Property Manager will pay for the shipping costs. The goal is to identify the number of units and permanent fixtures available with each apartment unit. Property Managers will install CFLs into the permanent fixtures during their routine maintenance visits and provide tracking for each unit and the number of bulbs installed. Duke Energy will upload the results upon completing the bulb installation.

a. We are currently working on an RFP to identify a 3rd party vendor to manage the Property Manager program. The RFP review selection should be completed by Mid-June of 2010.

4. Door to Door Canvassing – Duke Energy is piloting a door to door canvassing event in Ohio (May 15, 2010). Duke Energy is working with the Greater Cincinnati Energy Alliance to conduct a CFL canvassing offer for a free 6-pack of CFLs delivered directly to customers' homes in targeted neighborhoods. Each kit will be tracked to a Duke Energy account and the results will be uploaded upon completion of the event. If the event proves successful, we will look at additional non-profit organizations in other Duke Energy approved states to conduct the other door to door canvassing events.

These efforts reflect not only a desire on Duke Energy's part to market the CFL product, but these efforts reflect a strategic planning framework for increasing exposure to and sales of CFLs. It is gratifying to see utilities go beyond the use of limited marketing and promotional approaches and use different strategies that reach out to customers via multiple approaches.

Evaluation Findings

Process Evaluation

Program Design and Operations

The overall design of the program as related by program managers is to encourage people to start thinking in terms of energy efficiency in their homes and not necessarily to push CFLs specifically. CFLs are not seen as a long-term program offering but instead serve as a bridge to emerging technologies like LEDs and potentially high efficiency incandescent bulbs. Program managers also view the CFL offering as a high profile entry point for informing customers of other energy efficient technologies that are currently available through Duke Energy's programs such as programmable thermostats, high efficiency appliances, etc.

Program managers noted that while savings are measured at the bulb level, the program focuses on customers and the number of customers that can be cost effectively reached for the typical number of bulbs per participating customer. Managers report that the program is not an attempt at marketing CFLs to the point of socket saturation, but is an attempt to raise awareness of energy efficient products and behaviors via a focus on CFLs.

The customer incentive (value of the coupon) is delivered using direct-mail manufacturers' coupons partnering with GE, and for a period prior to the completion the program partnered with Lowe's and Walmart and offered coupons for *BrightEffects* bulbs. Originally the program partnered with individual retailers; however Duke wanted the coupons to be used in more places than just the retail partner locations. This change was also needed because the program found that some of the partnering retailers did not stock the inventory needed by the program, thereby reducing sales and making redemption problematic. As a result, Duke switched from the use of retailer coupons to using manufacturers coupons, significantly expanding the locations available for coupon redemption. However, while this approach expanded the places where coupons could be redeemed, opening up new outlets (ACE Hardware, TruValue, Lowe's, Walmart, and rural hardware stores for example), it also served to limit redemption to only stores that carry GE bulbs. Retail stores, such as Home Depot, that do not carry GE CFLs could not take part in the CFL push efforts.

The coupons are tiered. Customers can buy three CFLs to try them out, or any combination of 3 bulbs (6, 9, 12) up to 15 if they want to acquire multiple bulbs at the same time.

The program is very popular with retailers. Neither of the retail partners interviewed could identify a component of the program or the approach used that is in need of improvement and indicated that their sales are very positively affected by the coupons.

Program managers however, suggest that there is room for expansion in CFL sales because of the number of sockets still filled with incandescent bulbs and the potential for expanded adoption of the technology. Managers report concern that with the changes in the federal standard, the window for CFLs as a program-pushed technology is not more than two years. Retail partners agree but also think that there is room for sales growth and report that saturation of first-time

buyers is only 20% of the market with 80% of the households in their retail areas not yet adopting CFLs. They also report that second-time buyers need an incentive to continue to buy CFLs. They note that the vast majority of sockets are still filled with incandescent bulbs and note the availability of specialty CFL bulbs that can capture a larger share of the market. Retailers note that they continue to sell far more standard bulbs than CFLs.

Program managers note that the approach using GE bulbs works well because GE has their own fulfillment house that pays the stores the Duke Energy incentive and then bills Duke for those coupon sales, greatly simplifying the operations of the program thereby increasing program cost effectiveness. It also allows the GE fulfillment house to maintain accurate records on program sales that are then made available to Duke Energy as a program tracking metric. In this way Duke Energy can avoid much of the management and administration costs of the coupon payments and focus on tracking customers, market share progress and energy savings from those who used the coupons.

Challenges

In Ohio the numbers of coupon users per number of coupons distributed are dropping and may indicate a beginning of reduction in need for additional CFLs for coupon users. While customers who use their coupons are not sent follow-up coupons, managers note that some customers just don't use coupons. Managers note that they need to find a cost effective way to motivate the non-coupon user to buy CFLs now rather than waiting until they have no choice.

The mailing of coupons is targeted by zip code and calibrated to the need for savings and the budget for the program. Partners are informed of the mailing, and store managers report that it can be a challenge to anticipate the high traffic. Some store managers report an increase in CFL sales volumes of 500%. As an example, Sylvania (before the switch to GE) gave Duke four weeks of data on sales before a coupon mailing. After the mailing the volume jumped to 10 times the weekly average for several weeks.

As a result, store managers report needing as much lead time as possible to plan for the increased traffic. They report that because they order their bulbs months in advance, they need longer notification lead times. . However, when asked what changes are needed to the program, retail managers only identified the need for longer lead times between notification of the mailings and the actual mailing to allow them to prepare for the sales surge and the need to extend the coupon expiration date to allow for a longer sales period.

Response to Slowed Redemption Rates

Duke Energy managers noted that they are starting to see a drop in redemption rates as the coupon users become saturated and sales to this segment are slowing. Duke Energy is exploring ways to boost the number of program-induced sales and are now starting to include a CFL coupon offer to customers who contact the Duke Energy call center with billing questions or for other reasons. Managers are also starting to piggyback CFL coupons on other efficiency programs so that as customers inquire about other programs and services they are offered CFL coupons. Duke Energy is also currently exploring the opportunities for partnering with property

managers and apartment owners to help promote CFL use by their tenants. Each of these approaches represents an added market niche for pushing CFL adoption and use to save energy. In view that the costs for CFLs are low, and savings are comparatively high for such a low cost item, it make sense for Duke Energy to move as many of the CFLs into the market as possible in ways that acquire net savings that are below program costs. In view that there is a need to acquire net savings to meet Duke Energy's savings goals, all cost effective routes for moving CFLs into the market should be explored until such time that new federal appliance standards make CFLs mandatory. Exploring and using all cost effective routes into the market, until such time as the market is effectively transformed, as documented by a market conditions in which most sockets are filled with efficient lighting products, can also serve as market channels for more efficient LED bulbs or other similar products as they become cost effective to deliver via these same routes. At this time the CFL market does not appear to be transformed and should not be considered transformed until the vast majority of bulbs sold are at least as efficient as CFLs. Retail managers report that the vast majority of the bulbs they sell remain incandescent bulbs. This period of time, in which the market still buys incandescence bulbs as the lighting technology of choice represents an opportunity period in which new net savings can be acquired via approaches that increase the sales and use of CFLs. This market opportunity may not last but a few more years as Duke Energy and other market interventions transform the market to the point where CFLs represent the majority of sales and net new savings become difficult to acquire.

CFL Coupon Redeemers

This survey focused on customers who, according to program tracking records, redeemed their CFL coupons. The survey was mailed out to 1,000 customers who had redeemed their CFL coupons. Of these, 209 surveys were returned, for a 20.9% response rate. Of those surveys returned, 200 had valid responses and were included in the final data set.

Participation in the Program

Nearly all redeemers responding to the survey (96.0%) recall receiving CFL coupons in the mail. Similarly, most of the redeemers kept all of the coupons provided by Duke Energy (84.4%) while some gave at least one of their coupons away to another user (15.6%). However, 9% of the respondents indicated that they did not redeem at least one of the coupons, indicating that others may have redeemed them. And 91% of the respondents indicated that they redeemed at least one coupon. This indicates that at least a few of the respondents were not aware that someone in their household redeemed at least one coupon. A few respondents may have given some of their coupons away, and were not aware that the recipient redeemed them.

	Yes	No	Total
Do you recall receiving compact fluorescent light bulb (CFL) coupons from Duke Energy?	192	8	200
	96.0%	4.0%	100.0%
	Yes	No	Total
Did you give away any of your coupons to someone else to use?	30	162	192
	15.6%	84.4%	100.0%

	Yes	No	Total
Did you use at least one coupon yourself?	182	18	200
	91.0%	9.0%	100.0%

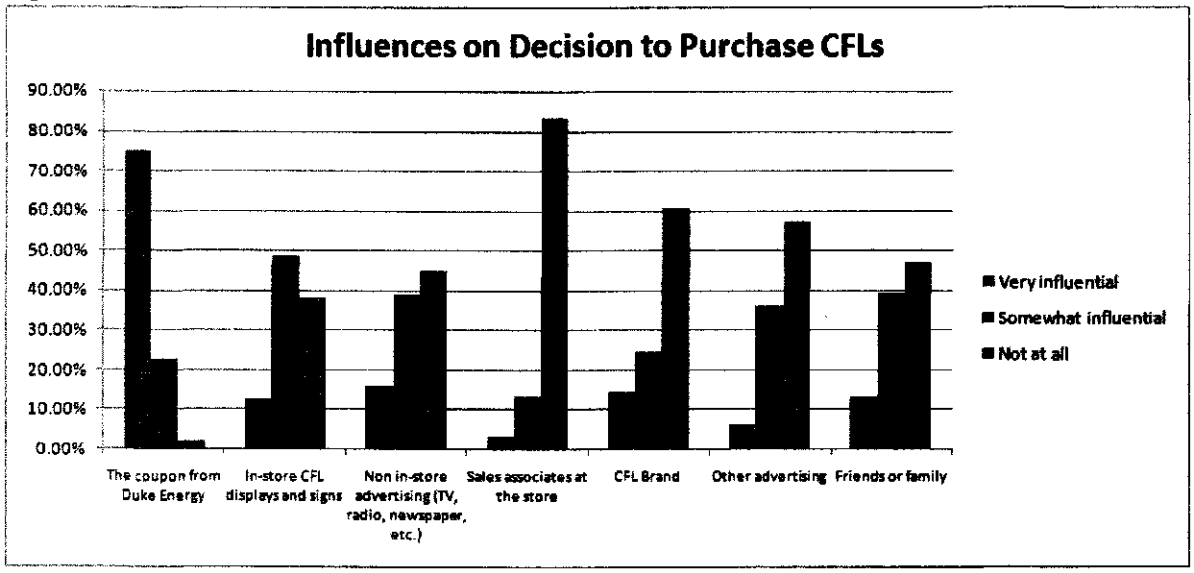
Seventy-five percent (75.1%) of redeemers found the coupon from Duke Energy to be "very influential" in their decision to purchase CFLs, indicating that the coupon was a key purchase driver. Although previous Duke Energy CFL studies have found the CFL coupon from Duke Energy to be even more influential, the coupon still seems to be the main driver in redeemers' decisions to purchase CFLs.[5] In-store CFL displays and signs were found to be somewhat influential, and other forms of advertising were found to be not at all influential by most redeemers. Redeemers did not find CFL branding or friends and family recommendations to be influential in their decision to purchase CFLs. As indicated in the following table, the Duke Energy coupon was the primary driver leading to the purchase of the program-induced CFL by a significant margin, however, the decision was also influenced, to a limited degree, by other events.

How influential were the following in your decision to purchase CFLs?

	Very influential	Somewhat influential	Not at all	Total
The coupon from Duke Energy	136	41	4	181
	75.1%	22.7%	2.2%	100.0%
In-store CFL displays and signs	21	80	63	164
	12.8%	48.8%	38.4%	100.0%
Non in-store advertising (TV, radio, newspaper, etc.)	26	63	73	162
	16.0%	38.9%	45.1%	100.0%
Sales associates at the store	5	21	131	157
	3.2%	13.4%	83.4%	100.0%
CFL Brand	23	39	96	158
	14.6%	24.7%	60.8%	100.0%
Other advertising	10	57	90	157
	6.4%	36.3%	57.3%	100.0%
Friends or family	21	61	73	155
	13.5%	39.4%	47.1%	100.0%

[5] "An Evaluation of Energy Star Products: Results of a Process and Impact Evaluation of Duke Energy's CFL Promotion and Lighting Logger Programs" prepared for Duke Energy by TecMarket Works and Building Metrics, September 24, 2008, page 38. This study will be referenced as the "2008 study" through this report.

Figure 1. Influences on Decision to Purchase CFLs - Redeemers



According to Duke Energy tracking records, redeemers who were mailed a coupon redeemer survey redeemed coupons good for the purchase of CFLs at either Walmart or Lowe's stores. At the time the surveys went out, Duke Energy had also recently initiated an additional CFL campaign, which offered a manufacturer's coupon good for CFL bulbs redeemable at any store selling the manufacturer's bulbs.[6] As shown in the table below, most redeemers did recall purchasing their CFLs at either Lowe's or Walmart using the CFL coupons. In addition, redeemers also mentioned stores where they may have purchased CFL bulbs using the manufacturer's coupons.

At which store did you purchase your CFL bulbs using the Duke Energy coupons?

Walmart	80	36.20%
Lowes	54	24.43%
Not Specified	47	21.27%
Home Depot	26	11.76%
Meijer	5	2.26%
Kroger	4	1.81%
Target	3	1.36%
Ace Hardware	1	0.45%
Walgreens	1	0.45%
Total	221	100.00%

[6] Due to the short time span (approximately one month) between the drop of the manufacturer's campaign and the mailing of this survey, only a few customers would have recalled receiving or redeeming manufacturer's coupons.

Redeemers were asked if they purchased any of the following additional items when they purchased their CFLs: wall/ceiling insulation, faucet aerators, showerheads, weather stripping, caulking, outlet gaskets, or programmable thermostats. Most redeemers did not purchase additional items when purchasing their CFLs (85.3%), however, those redeemers who did purchase additional items purchased either weather stripping or caulking. These purchase decisions are compared to those of coupon non redeemers later in this report.

Did you purchase any of the following items at the same time you purchased the CFLs with the Duke Energy coupons?

None	133	85.30%
Caulking	10	6.40%
Weather stripping	9	5.80%
Low flow showerhead	2	1.30%
Faucet aerators	1	0.60%
Electric wall outlet gaskets	1	0.60%
Wall or ceiling insulation	0	0.00%
Programmable thermostat	0	0.00%

Use of CFL Coupons

Redeemers could have purchased between 3 and 15 bulbs using the Duke Energy coupons. The majority of redeemers stated they purchased 12 or more CFLs, with similar number of redeemers stating they purchased 6 or 7-11 CFLs. This data indicates that not only was the Duke Energy coupon the key driver for the purchase decision, but that purchase decisions typically involved 6 or more bulbs. A small number of redeemers stated that they purchased 1 or 2 CFLs. Since the CFLs eligible for the coupons were packages of 3 or 6 bulbs, these redeemers may have been describing the number of packages of CFLs they purchased, or they did not recall the number of bulbs purchased and were providing their best guess.

Just over one quarter of redeemers stated they installed 6 of the CFLs they purchased using the Duke Energy coupons. A comparison of the number of CFLs a redeemer stated to have purchased vs. the number of CFLs a redeemer installed shows that on average redeemers are installing 83.1% of the CFLs they purchase using Duke Energy coupons. That is, not only is the program causing the purchase decision, but the vast majority of the bulbs are being installed and used immediately upon purchase.

How many CFL bulbs did you purchase in TOTAL with the Duke Energy coupon(s)?

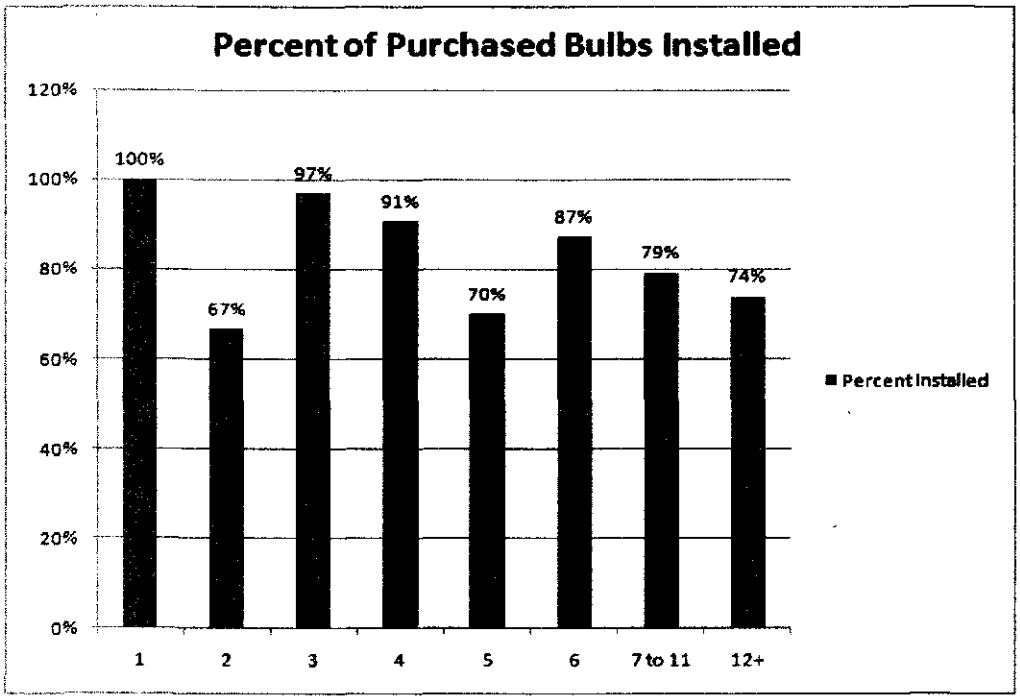
1	2	3	4	5	6	7-11	12+	Total

2	3	11	30	2	43	39	47	177
1.1%	1.7%	6.2%	16.9%	1.1%	24.3%	22.0%	26.6%	100.0%

Of the CFLs you bought with the Duke Energy coupons: How many CFLs are now installed?

0	1	2	3	4	5	6	7-11	12+	Total
1	3	11	17	36	8	47	31	24	178
.6%	1.7%	6.2%	9.6%	20.2%	4.5%	26.4%	17.4%	13.5%	100.0%

Figure 2. Percent of Purchased Bulbs Installed



About one third of redeemers stated that they would not have bought any CFLs without the coupon (33.5%), and an even larger number of redeemers (47.5%) stated that they have not purchased any additional CFLs since using the coupon. These two statements corroborate the previous statement made by redeemers that receiving the coupon in the mail was most influential in a participant's decision to purchase CFLs. However, a higher percentage of redeemers agreed with these two statements in the previous Duke Energy Ohio CFL study[7] , suggesting that redeemers' adoption of CFLs on their own may be increasing.

[7] In "An Evaluation of Energy Star Products: Results of a Process and Impact Evaluation of Duke Energy's CFL Promotion and Lighting Logger Programs" prepared for Duke Energy by TecMarket Works and Building Metrics, September 24, 2008, 52.8% of customers stated they would not have bought any CFLs without the Duke Energy coupon, and 69.8% of customers stated they had not purchased any additional CFLs since purchasing CFLs with the Duke Energy coupon.

How many CFL bulbs would you have bought if you had not had the Duke Energy coupon(s)?

0	1	2	3	4	5	6	7-11	12+	Total
58	11	20	14	23	0	21	16	10	173
33.5%	6.4%	11.6%	8.1%	13.3%	.0%	12.1%	9.2%	5.8%	100.0%

How many CFL bulbs have you since purchased without Duke Energy coupons?

0	1	2	3	4	5	6	7-11	12+	Total
84	4	19	16	14	2	18	9	11	177
47.5%	2.3%	10.7%	9.0%	7.9%	1.1%	10.2%	5.1%	6.2%	100.0%

CFL Usage and Satisfaction

Most redeemers have not altered their behavior after installing their CFLs; that is, they have not changed the hours of use of fixtures (87.1%), and they have not removed any of the CFLs they installed (84.0%). Of those redeemers who did change their usage, over half increased it (59.1%), and of those redeemers who did remove a CFL they had installed, over two thirds of redeemers did so because the bulb burned out.

	Yes	No	Total
Have you changed the hours of use of any fixture in which you installed the CFLs?	22	148	170
	12.9%	87.1%	100.0%

	Increased usage	Decreased usage	Total
If you answered yes, how did your average usage change?	13	9	22
	59.1%	40.9%	100.0%

	Yes	No	Total
Have you removed any of the CFLs you installed?	26	136	162
	16.0%	84.0%	100.0%

	1	2	3	4	5	6	7-11	12+	Total
If yes, how many did you remove?	20	13	2	2	2	1	0	1	41
	48.8%	31.7%	4.9%	4.9%	4.9%	2.4%	.0%	2.4%	100.0%

	Not bright enough	Did not like the light	Too slow to start	Burned out	Not working properly	Other	Total
Why did you remove them?	6	1	3	27	1	2	40
	15.0%	2.5%	7.5%	67.5%	2.5%	5.0%	100.0%

Other:

- My 2 year old tipped lamp and broke the bulb...I hope you realize how dangerous the mercury is to a child.
- Bare bulbs are okay. Enclosed globe and flood bulbs are too slow to start.
- Base is loose.
- Bulb didn't work in custom lamp.

- Changed paint color on walls.
- Did not remove but may in the future. Too expensive and does not last long as promised by the manufacturer.
- Doesn't work!
- I replaced with CFL also.
- None removed, though some are not bright enough.
- They do not last longer than 5 years.
- What do we use with motion detectors?

Not quite half of redeemers stated they already had at least one CFL installed in their house before purchasing bulbs with Duke Energy coupons, and just over half of redeemers stated they did not already have CFLs installed. Of those redeemers who indicated that they had already installed a CFL, 59.8% had already installed 2, 3, or 4 bulbs. The majority of the other redeemers had more than 4 bulbs installed in their home. Nearly the same number of redeemers in a previous Duke Energy study had between 1 and 4 bulbs installed in their home before receiving the Duke Energy coupons (2008 - 65.6%; 2009 – 66.7%).

	Yes	No	Total
Did you have any CFLs installed in light sockets in your house before you bought the CFLs with the Duke Energy coupon?	75	95	170
	44.1%	55.9%	100.0%

	1	2	3	4	5	6	7-11	12+	Total
If yes, about how many were already installed?	5	19	12	12	6	7	5	6	72
	6.9%	26.4%	16.7%	16.7%	8.3%	9.7%	6.9%	8.3%	100.0%

Only about one third of redeemers indicate that they have been using CFLs for 1-2 years, and nearly 75% of these redeemers are very satisfied with their CFLs. This data suggests that CFL saturation is still low within the coupon redeeming population prior to the use of the Duke Energy coupon.

	Never purchased until now	1 year or less	1-2 Years	2-3 Years	3-4 Years	4 or more years	Total
How long have you been using CFL light bulbs?	21	44	58	28	9	13	173
	12.1%	25.4%	33.5%	16.2%	5.2%	7.5%	100.0%

	Very Satisfied	Somewhat satisfied	Not at all satisfied	Total
Overall, how satisfied are you with the	130	41	5	176

Duke discounted CFLs?	73.9%	23.3%	2.8%	100.0%

ENERGY STAR Awareness

Over 75% of redeemers state that they never use the Duke Energy website. Most redeemers (80.7%) are aware of the ENERGY STAR label, and 71.4% of redeemers look for the label when purchasing appliances. About half of redeemers typically purchase an appliance with an ENERGY STAR label.

	Often	Sometimes	Never	Total
Do you use the Duke Energy Website?	8	34	138	180
	4.4%	18.9%	76.7%	100.0%

	Yes	No	Total
Have you added any major electrical appliances to your home in the past year?	28	143	171
	16.4%	83.6%	100.0%

	Yes	No	Total
Are you aware of the ENERGY STAR label?	142	34	176
	80.7%	19.3%	100.0%

	Yes	No	Total
Do you typically look for the ENERGY STAR label when purchasing an appliance?	125	50	175
	71.4%	28.6%	100.0%

	Yes	Some of the time	Never	Total
Do you typically buy appliances with the ENERGY STAR label?	90	51	24	165
	54.5%	30.9%	14.5%	100.0%

Future CFL Purchases

Redeemers were asked to consider their future CFL purchases and identify how many CFLs they would expect to purchase in the next year if CFLs were offered at a certain price compared to a standard (incandescent) bulb. With CFLs being offered at the same prices as a standard bulb, 91.1% of redeemers will purchase at least one CFL, and most frequently will purchase 12 or more. Similarly, a majority of redeemers (over half) will purchase any number of CFLs at prices above a standard bulb, until the price reaches $3.00 more. At prices of $3.00 more than a

standard bulb, 58.3% of redeemers will not purchase CFLs. This data suggests that the market remains price sensitive to the higher price of the unincented CFL.

If the CFL bulbs are free with a rebate form, 14.2% of redeemers said that they will purchase zero CFLs. This suggests that some redeemers are experiencing a barrier other than price when deciding to purchase CFLs; for example, redeemers may not be at all interested in purchasing CFLs due to size, aesthetics or the quality of light and would purchase no CFLs regardless of price. In addition, for some of these redeemers the hassle of the rebate process may outweigh other advantages of purchasing CFLs; for example, a small number of redeemers (10) who stated they would purchase CFLs at a price equal to standard bulbs would not purchase them if they were free through the use of a rebate.

Considering future CFL purchases, how many CFL bulbs would you purchase in the next year if...

		0	1-2	3	4	5	6	7-11	12+	Total
They were the same price as a standard bulb?	Count	14	12	8	28	8	37	13	38	158
	%	8.9%	7.6%	5.1%	17.7%	5.1%	23.4%	8.2%	24.1%	100%
They were $1.00 more than standard bulbs?	Count	33	17	13	23	13	24	8	15	146
	%	22.6%	11.6%	8.9%	15.8%	8.9%	16.4%	5.5%	10.3%	100%
They were $2.00 more than standard bulbs?	Count	62	18	9	22	6	15	4	6	142
	%	43.7%	12.7%	6.3%	15.5%	4.2%	10.6%	2.8%	4.2%	100%
They were $3.00 more than standard bulbs?	Count	84	15	8	19	3	8	3	4	144
	%	58.3%	10.4%	5.6%	13.2%	2.1%	5.6%	2.1%	2.8%	100%
They were free but you had to mail in a rebate form to get your money back?	Count	21	7	7	22	7	26	15	43	148
	%	14.2%	4.7%	4.7%	14.9%	4.7%	17.6%	10.1%	29.1%	100%

CFL Coupon Non-Redeemers

This survey focused on customers who according to program tracking records did not redeem CFL coupons, and was mailed out to 1000 respondents who did not redeem coupons. 104 surveys were returned, for a 10.4% response rate.

Awareness of Advertising

14.7% of non-redeemers do not remember receiving any CFL coupons, and of those who did recall receiving the coupons, 59% stated that they did not use any of the coupons. Nearly three quarters of non-redeemers stated that they had heard about the CFL program (71.4%). Nearly 15% of non-redeemers stated that they did not redeem the coupons because they do not shop at Wal-Mart or Lowe's. These non-redeemers might be interested in participating in a CFL program with a retailer coupon for another store or participating in a program offering a manufacturer's coupon. (For example, they may have been a participant in the manufacturer's coupon campaign Duke Energy ran subsequently to this offer.)

	Yes	No	Total
Do you recall receiving Compact Fluorescent Light bulb (CFL) coupons from Duke Energy?	87	15	102
	85.3%	14.7%	100.0%

Why did you decide NOT to use these coupons?

Too much hassle	2	4.40%
Do not use CFL's	6	13.30%
Do not shop at WalMart / Lowe's	6	13.30%
Did not understand program	2	4.40%
Thought there was a catch	1	2.20%
Could not be bothered	3	6.70%
Don't like CFL's	6	13.30%

If other, please specify:

- All of the bulbs I received from you were broken except for one and it lasted 2-3 months.
- All ready have some (6)
- Bought some at Sam's Club because they were cheaper (2)
- CFL bulbs have mercury in them
- Did not need bulbs; cannot afford CFL's
- Did not receive the coupons (3)
- Do not have light sockets in my apartment to use the CFL Bulbs

- Do not need bulbs yet
- Got same from people helping co-op
- Have not needed to replace any bulbs recently
- I am concerned about the mercury in CFLs and the fact that you cannot dispose of them in the regular trash.
- I had already bought over 20 of them at the dollar store where they were cheaper without the coupon you sent out
- Junk mail is Junk mail
- Just did not need them before they expire
- Lamp shades do not fit
- Takes more time to fully light. Not as bright
- They expired
- Too costly and already had some on hand
- Unsightly
- We do not usually buy the bulbs

Over half of non-redeemers stated that the CFL coupons did not increase their awareness of how to save energy using CFLs (60.8%), nor inspired them to purchase CFLs somewhere else without the coupon (78.0%). Unlike for coupon redeemers, the CFL coupon itself is not a strong factor in these non-redeemers' decisions to purchase CFLs with or without the Duke Energy coupon. Of those who did purchase bulbs elsewhere, most non-redeemers purchased 1, 2, or more than 6 bulbs (66.6%).

	Yes	No	Somewhat aware	Total
Did receiving the Compact Fluorescent Light bulb coupons increase your awareness of how you could save energy by using compact fluorescent light bulbs?	13	31	7	51
	25.5%	60.8%	13.7%	100.0%

	No	Yes	Total
Did the Compact Fluorescent Light bulb coupons inspire you to purchase compact fluorescent light bulbs without using the Duke Energy coupons?	39	11	50
	78.0%	22.0%	100.0%

	1	2	3	4	5	6	more than 6	Total
If "Yes", how many CFLs did you purchase without the coupons?	2	2	1	1	0	1	2	9
	22.2 %	22.2 %	11.1 %	11.1 %	0%	11.1 %	22.2%	100.0 %

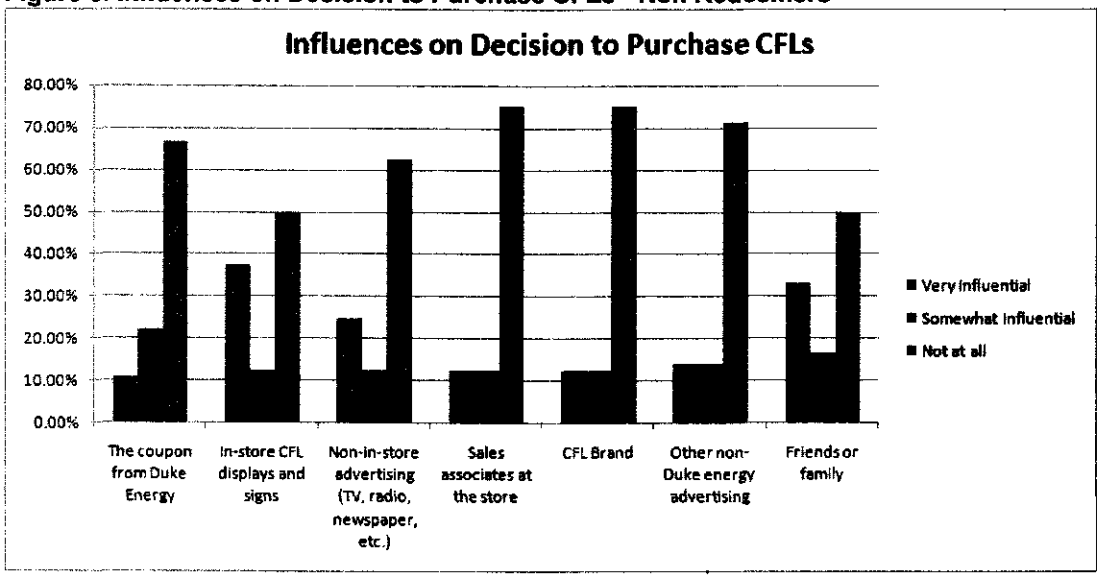
Of the non-redeemers who stated they purchased CFLs without the coupons, most non-redeemers were not influenced by any of the factors listed below. Some non-redeemers were

very influenced by friends and family (33.3%), in store CFL displays (37.5%), and other advertising (25.0%). Non-redeemers who purchased CFLs without the Duke Energy coupons shopped at several stores, including Home Depot, Kroger, Sam's Club, and Walmart.

How influential were the following in your decision to purchase CFL(s) without the coupons?

	Very Influential	Somewhat Influential	Not at all	Total
The coupon from Duke Energy	1	2	6	9
	11.1%	22.2%	66.7%	100.0%
In-store CFL displays and signs	3	1	4	8
	37.5%	12.5%	50.0%	100.0%
Non-in-store advertising (TV, radio, newspaper, etc.)	2	1	5	8
	25.0%	12.5%	62.5%	100.0%
Sales associates at the store	1	1	6	8
	12.5%	12.5%	75.0%	100.0%
CFL Brand	1	1	6	8
	12.5%	12.5%	75.0%	100.0%
Other non-Duke energy advertising	1	1	5	7
	14.3%	14.3%	71.4%	100.0%
Friends or family	4	2	6	12
	33.3%	16.7%	50.0%	100.0%

Figure 3. Influences on Decision to Purchase CFLs - Non Redeemers



	Home Depot	Kroger	Sam's Club	Walmart	Total
At which store did you purchase your CFL	3	2	2	1	8
	37.50%	25.00%	25.00%	12.50%	100.00%

bulbs?					

Unlike the CFL coupon redeemers, coupon non-redeemers did not purchase any of the additional items listed below when they purchased their CFLs. This may suggest that non-redeemers who purchased CFLs without coupons already have these additional items installed in their home. Other reasons may include that non-redeemers purchasing CFLs on their own already have these additional items installed in their home, or non-redeemers are making a shopping trip specifically to purchase CFLs.

Since, unlike coupon non-redeemers, coupon redeemers did purchase additional items at the same time they purchased their CFLs, it is possible that coupon redeemers were inspired by the Duke Energy coupons to adopt CFLs, as well as to purchase additional energy saving items for their home. (See the earlier discussion of the coupon redeemer survey for a description of the items purchased by coupon redeemers.)

Did you purchase any of the following items at the same time you purchased the CFLs? Mark all that apply.

Wall or insulation	0	0%
Faucet aerators	0	0%
Low flow showerhead	0	0%
Weatherstripping	0	0%
Caulking	0	0%
Electric wall outlet Gaskets	0	0%
Programmable thermostat	0	0%
None of these	10	100%
Total	10	100%

One quarter of coupon non-redeemers stated they have 0 CFLs installed in their home. Of those who do have CFLs in their house, over 25% of non-redeemers stated they have 7 or more CFLs installed in their home. These installation rates reflect non-redeemers earlier statements that they did not purchase CFLs using the Duke Energy coupons because they already had purchased bulbs and/or did not need any new ones before the coupons expired. This data also suggests that typical non-redeeming customers may not be purchasing bulbs to store away for future use, and are using all or most of the bulbs that they purchase.

	0	1	2	3	4	5	6	7-11	12+	Total
How many CFLs are currently	14	3	6	4	7	3	3	9	6	55

installed in light sockets in your home?	25.5%	5.5%	10.9%	7.3%	12.7%	5.5%	5.5%	16.4%	10.9%	100.0%

Most non-redeemers stated they had been using CFL bulbs for 1-2 years (30.9%). Some non-redeemers have been using CFLs for 4 or more years, but a majority of non-redeemers have been using CFLs for two years or less. Non-redeemers who have purchased CFLs are satisfied or very satisfied with the CFLs they purchased.

	Never purchased	1 Year or less	1-2 Years	2-3 Years	3-4 Years	4 or more years	Total
How long have you been using CFL light bulbs?	13	13	17	7	3	2	55
	23.6%	23.6%	30.9%	12.7%	5.5%	3.6%	100.0%

	Very Satisfied	Somewhat Satisfied	Not at all	Total
If you have purchased CFLs, overall, how satisfied are you with the CFLs you purchased?	17	19	6	42
	40.5%	45.2%	14.3%	100.0%

ENERGY STAR Awareness

Most non-redeemers stated that they do not use the Duke Energy website (69,6%). Almost three quarters of non-redeemers (71.4%) have not added any electrical appliances to their homes. Nearly all responding non-redeemers state that they are aware of ENERGY STAR (80.4%), and over half of non-redeemers look for the ENERGY STAR label when purchasing an appliance (64.8%).

	Often	Sometimes	Never	Total
Do you use the Duke Energy Website?	4	13	39	56
	7.1%	23.2%	69.6%	100.0%

	Yes	No	Total
Have you added any major electrical appliances to your home in the past year?	16	40	56
	28.6%	71.4%	100.0%

	Yes	No	Total
Are you aware of the ENERGY STAR label?	45	11	56

	80.4%	19.6%	100.0%

	Yes	No	Total
Do you typically look for the ENERGY STAR label when purchasing an appliance?	35	19	54
	64.8%	35.2%	100.0%

	Yes	Some of the time	Never	Total
Do you typically buy appliances with the ENERGY STAR label?	26	20	7	53
	49.1%	37.7%	13.2%	100.0%

Future CFL Purchases

Non-redeemers were asked to describe how they would make CFL purchases in the future, given that CFLs were a certain price compared to a standard light bulb. At the same price as a standard bulb, most non-redeemers would either purchase six, or 12 or more CFLs. At a price of $1.00 more than a standard CFL, a majority of non-redeemers would still purchase CFLs, although they would purchase fewer bulbs overall. Once the price of the bulb rises above the cost of a standard bulb by $2.00 or more, the majority of non-redeemers would purchase 0 CFLs. Interestingly, if a CFL was free, but you had to mail in a rebate form to receive a refund, more non-redeemers would purchase no CFLs than would if the CFL was the same price as a standard bulb. However, more non-redeemers would purchase 12 or more CFLs if they were free, than would if they were the same price as a standard bulb. These two results suggest that having to initially pay for a free CFL bulb is a hassle and deterrent to CFL purchases for some non-redeemers, but an ultimately free bulb is an encouragement for other non-redeemers to purchase more CFLs.

Considering future CFL purchases, how many CFL bulbs would you purchase in the next year if they were…

		0	1-2	3	4	5	6	7-11	12+	Total
…the same price as a standard bulb?	Count	8	3	2	5	4	10	9	10	51
	%	15.7%	5.9%	3.9%	9.8%	7.8%	19.6%	17.6%	19.6%	100.0%
…$1.00 more than standard bulbs?	Count	18	3	2	6	6	7	7	3	52
	%	34.6%	5.8%	3.8%	11.5%	11.5%	13.5%	13.5%	5.8%	100.0%
…$2.00 more than standard bulbs?	Count	26	7	1	9	2	4	2	2	53
	%	49.1%	13.2%	1.9%	17.0%	3.8%	7.5%	3.8%	3.8%	100.0%
…$3.00 more than standard bulbs?	Count	36	4	2	1	4	2	1	2	52
	%	69.2%	7.7%	3.8%	1.9%	7.7%	3.8%	1.9%	3.8%	100.0%
…free but you had to	Count	13	5	2	5	1	7	7	11	51

mail in a rebate form to get your money back?	%	25.5%	9.8%	3.9%	9.8%	2.0%	13.7%	13.7%	21.6%	100.0%

Impact Evaluation

The savings presented in this section were calculated using survey data from participants in the 2009 CFL campaigns. Customers provided data describing their installation of the CFL bulbs purchased with Duke Energy coupons. This data was supplemented with lighting logger data collected from participants' homes during the months of August 2009. The hourly use from the logger data was adjusted to reflect yearly averages using the day-length algorithm developed via a larger logger study conducted in California that documented the monthly change in lighting usage due to seasonal variances in day length. These two data sets were combined to calculate the per-bulb savings for this program to include the day-length adjustment to logged hours of use.

Self Reported CFL Data

Customers who returned surveys indicating their participation in the CFL program (some of whom also participated in the lighting logger study) were asked to indicate where the CFL bulbs they purchased were installed, what wattage of bulb the CFLs replaced, and approximately how many hours the bulbs were used each day. 3 below presents the responses from the 200 survey responses obtained from those that redeemed the CFL coupons.

Table 4. CFL Redeemer Survey: Self Reported Location of Purchased Bulbs, n=200

	Number of Replacements by Room	Percent of Respondents Replacing at Least One Bulb in This Room	Average Wattage of Bulb Replaced	Average Self Reported Hours Bulb Used
Living Room	184	40.00%	50.65	3.62
Bedroom	164	36.00%	48.71	2.13
Kitchen	115	26.00%	47.83	4.73
Other	83	27.50%	52.94	2.31
Basement	79	18.00%	62.99	3.16
Bathroom	74	16.00%	45.01	2.27
Hallway	51	15.00%	51.08	2.36
Dining Room	31	7.50%	60.40	1.76
Garage	19	6.00%	70.37	1.29
Office	17	5.50%	47.94	3.29
Laundry Room	12	5.50%	56.67	3.98
Den	12	5.00%	66.25	4.00
Entryway	9	2.00%	60.00	1.17
Stairway	3	1.00%	60.00	3.50
Foyer	2	1.00%	30.00	3.50

Lighting Logger Study

In conjunction with the surveys, a lighting logger study was performed with a subset of customers who returned the CFL redeemer survey. The purpose of this logger study was to determine how customers who redeem Duke Energy coupons are using CFL bulbs (i.e., what

room or fixture are the bulbs installed in), as well as to determine the actual hours of use of these CFL bulbs. Customers who indicated on their survey that they were interested in participating in the lighting logger study were contacted by an outside market research firm to determine the customers' interest and availability to participate in the study. Duke Energy field technicians then set up appointments with the customer to install the lighting loggers.[8] The loggers remained in place for approximately three weeks during the month of August, and then were removed by the field technicians at follow up appointments. Customers received a $50 incentive for participating in the study. In total, 212 lighting loggers were installed in 58 homes.

CFL Placement and Wattage of Bulbs Replaced

As described in Table 4, about half of bulbs logged were GE brand (43.90%). Just over one third (34.10%) of the bulbs logged were in table lamps, with about one quarter of bulbs (26.50%) installed in a ceiling fixture. Over half of bulbs were 13 watts (54.00%) and nearly all the bulbs logged were CFLs. The most frequent locations for logged bulbs were the bedroom, kitchen, living room, bathroom, and dining room.

[8] The technicians were identified as Duke Energy representatives by their Duke Energy badges, Duke Energy clothing, and the Duke Energy magnets on their vehicles. All field technicians received proper employment screening prior to conducting this field work.

Table 5. Brand, Wattage, Bulb Type, Fixture Type, and Room of Logged Bulbs

Brand	Count	%
GE	104	49.30%
Bright Effects	49	23.20%
Commercial Electric	11	5.20%
Sylvania	9	4.30%
Hg	6	2.80%
Lights of America	5	2.40%
Ecosmart	3	1.40%
Feit Electric	3	1.40%
Invision	3	1.40%
N:Vision	3	1.40%
Other	3	1.40%
Conserv Energy	2	0.90%
Marathon	2	0.90%
Niagara	2	0.90%
Phillips	2	0.90%
Great Value	1	0.50%
Helius	1	0.50%
LKM514	1	0.50%
Meijer	1	0.50%

Wattage	Count	%
13	114	54.00%
20	25	11.80%
23	20	9.50%
14	15	7.10%
26	12	5.70%
9	5	2.40%
15	5	2.40%
25	5	2.40%
10	2	0.90%
30	2	0.90%
60	2	0.90%
5	1	0.50%
12	1	0.50%
19	1	0.50%
22	1	0.50%

Bulb Type	Count	%
CFL	209	99.10%
Incandescent	2	0.90%

Fixture Type	Count	%
Table Lamp	72	34.10%
Ceiling	56	26.50%
Ceiling Fan	33	15.60%
Floor Lamp	22	10.40%
Wall	21	10.00%
Can Light	3	1.40%
Hood Light	3	1.40%
Lamp	1	0.50%

Room	Count	%
Bedroom	53	25.12%
Living Room	39	18.48%
Kitchen	27	12.80%
Bathroom	18	8.53%
Dining Room	18	8.53%
Basement	17	8.06%
Hallway	15	7.11%
Family Room	9	4.27%
Entryway	5	2.37%
Other	3	1.42%
Garage	2	0.95%
Office	2	0.95%
Den	1	0.47%
Laundry Room	1	0.47%
Stairway	1	0.47%

Comparing customers' self reported hours of operation to the actual hours of operation shows that on average, customers responding to the survey overestimated their lighting usage by about 40%.[9]

Table 6. Self Reported and Actual Hours of Use

	Hours of Use					
Room	Self Reported	Actual	Difference (Self Rep - Actual)	%	Weight (from # of self reports)	Weighted Percentages
Basement	3.157	2.448	0.709	28.96%	0.10422164	3.02%
Bathroom	2.270	0.801	1.469	183.43%	0.09762533	17.91%
Bedroom	2.134	1.785	0.349	19.56%	0.21635884	4.23%
Den	4.000	0.626	3.374	538.98%	0.01583113	8.53%
Dining Room	1.760	2.318	-0.558	-24.06%	0.04089710	-0.98%
Entryway	1.167	1.917	-0.750	-39.14%	0.01187335	-0.46%
Garage	1.289	1.009	0.280	27.80%	0.02506596	0.70%
Hallway	2.358	3.216	-0.858	-26.68%	0.06728232	-1.80%
Kitchen	4.735	3.119	1.616	51.80%	0.15171504	7.86%
Living Room	3.622	3.516	0.106	3.02%	0.24274406	0.73%
Office	3.294	8.220	-4.926	-59.93%	0.02242744	-1.34%
Stairway	3.500	0.491	3.009	612.83%	0.00395778	2.43%
			Average	109.71%	Weighted Average	40.82%

Daylength Adjustments

The frequency and length of time a customer uses their CFL is affected by daylength. As days become longer and shorter throughout the year, the length of time a bulb needs to be used increases and decreases in rooms where natural lighting is used to offset CFL use. Depending on which time of the year lighting usage is measured, the amount of use recorded by the lighting loggers may over or under predict a customer's overall usage for the year. The amount of daylight during any given season is a factor of the position of the sun which determines the sunrise and sunset time and the number of hours of daylight. The increase and decrease in hours of daylight experienced throughout the year can be expressed as a sine function, and the average over or under prediction in hours of use as a result of increased or decreased daylight can be calculated using the following equation[10].

Equation 1: Hours/day = $hours/day_{average}$+Max deviation*sin(θ_d)

[9] "Other" category was not included in comparison. Rooms labeled "other" in lighting logger study were not directlycomparable to rooms labeled "other" in self reported survey results.
[10] The Cadmus Group. "Upstream Lighting Program Evaluation Report. Prepared for CPUC." November 16, 2009. Pg. 16.

This approach was used by the Cadmus Group to analyze seasonal light logger data in a large residential CFL study in California. To calculate the impact of daylight on daily use, a regression analysis was used to estimate the average hours per day and maximum deviation variables in the above equation from observed light logger data. The right side of the function represents a progression through the year where the right hand term goes to zero on the spring and fall equinox, is a maximum value at the winter solstice and a minimum value at the summer solstice.

Equation 2: $\theta_d = 2\pi(284+n)/365$

Where n = the Julian date (1 = Jan 1; 365 = Dec 31)

The Cadmus regression model predicted the annual average hours of use and the maximum deviation. The ratio of the maximum deviation to the annual average represents a the maximum percent difference in the daily hours of use relative to the annual average. The equation above can be used to predict the percent over or under estimation of lighting hours at any particular day of the year. This is the daylength adjustment factor. The Cadmus data are summarized in the Table below:

Logger wave	Daytype	Average Hours / day	Maximum deviation (hr)	% deviation
1	WD	1.73	0.35	20.2%
	WE	1.74	0.31	17.8%
2	WD	1.6	0.23	14.4%
	WE	1.6	0.26	16.3%
3	WD	1.89	0.25	13.2%
	WE	1.86	0.27	14.5%
Average		1.74	0.28	16.1%

Thus, the predicted maximum deviation from the annual average hours of use from the Cadmus study is on the order of ±16%.

To calculate the daylength adjustment factor for this lighting logger study, equation 2 was evaluated at the median date of the lighting logger study (August 15). This value was applied to the max deviation above to estimate the daylight adjustment factor.

Finally, the ratio of Equation 1 calculated for the date of the lighting logger study and the date of the nearest equinox is the percent over or under estimation of annual hours of use for the lighting logger study.

Based on the dates of the lighting logger study, the hours of use captured by the lighting logger study under predict actual hours of use per day for the year by approximately 9.1%. The data for these calculations for this study are shown in Table 6.

Table 7. Daylength Adjustment Calculation

Date	n	Sin(θ_d)	Max adjustment	August adjustment
15-Aug	277	0.59	16%	9.5%

The daylength adjusted average actual hours of use by room from the lighting logger study are shown below.

Table 8. Average Actual Hours of Use by Room – Daylength Adjusted

Basement	2.68
Bathroom	0.88
Bedroom	1.95
Den	0.69
Dining Room	2.54
Entryway	2.10
Garage	1.10
Hallway	3.52
Kitchen	3.42
Living Room	3.85
Office	9.00
Stairway	0.54

Comparing customers' self reported hours of use to the daylength adjusted actual hours of use shows that customers are overestimating their hours of use by 28% (Table 8). This is 12% less than the original calculation in Table 5., meaning after customers' actual hours of use are daylength adjusted, customers estimates are closer to their actual hours of use, but still overestimate their actual hours of use. The downward adjustment of 28.6% is applied to customers' self reported hours of use to calculate savings.

Table 9. Ratio (Actual/Self Reported HOU) – Daylength Adjusted

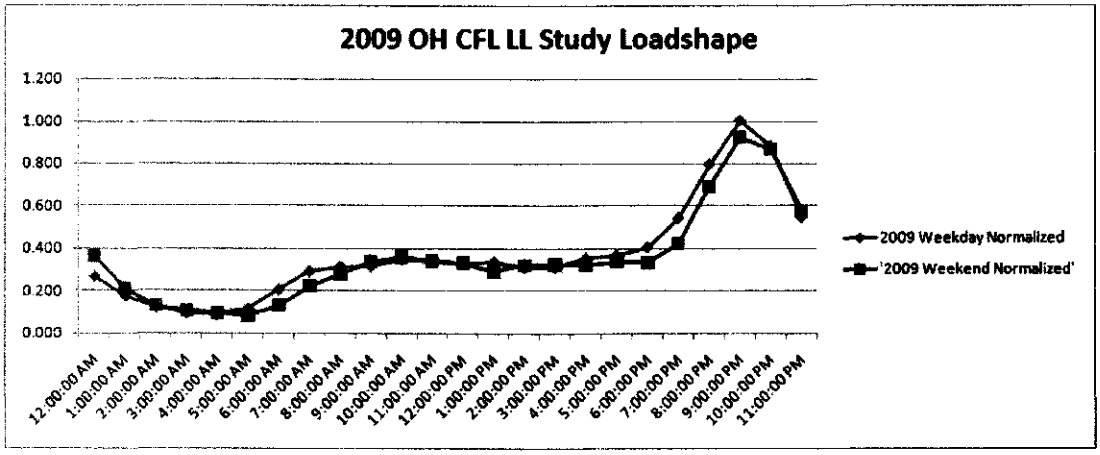
	Hours of Use					
Room	Self Reported	Actual Daylength Adjusted	Difference (Self Rep - Actual)	%	Weight (from # of self reports)	Weighted Percentages
Basement	3.157	2.681	0.476	17.77%	0.104222	1.85%
Bathroom	2.270	0.877	1.393	158.84%	0.097625	15.51%
Bedroom	2.134	1.955	0.180	9.19%	0.216359	1.99%
Den	4.000	0.685	3.315	483.54%	0.015831	7.66%
Dining Room	1.760	2.538	-0.778	-30.65%	0.040897	-1.25%
Entryway	1.167	2.099	-0.932	-44.42%	0.011873	-0.53%
Garage	1.289	1.105	0.185	16.71%	0.025066	0.42%
Hallway	2.358	3.522	-1.164	-33.04%	0.067282	-2.22%
Kitchen	4.735	3.415	1.319	38.63%	0.151715	5.86%
Living Room	3.622	3.850	-0.228	-5.92%	0.242744	-1.44%
Office	3.294	9.001	-5.707	-63.40%	0.022427	-1.42%

Stairway	3.500	0.538	2.962	550.99%	0.003958	2.18%
			Average	91.52%	Weighted Average	28.60%

Loadshape

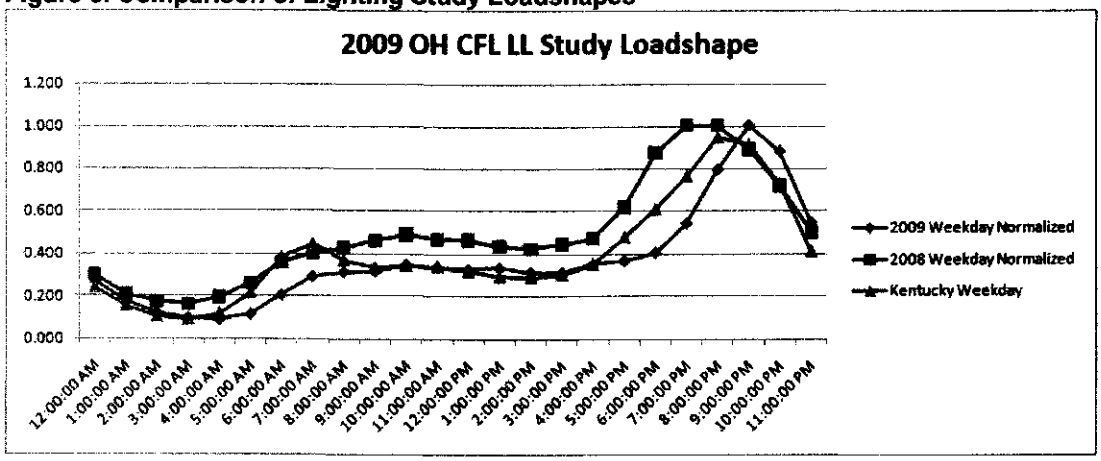
The customers' loadshape from August of 2009 is shown in Figure 5 below. The weekday and weekend hours of use are normalized to the highest weekday value. As the shape demonstrates, customers' lighting usage is at its peak around 8 or 9pm.

Figure 4. 2009 CFL Loadshape



Comparing the loadshape from this study with other Duke Energy Midwest lighting study loadshapes shows a pattern in lighting usage throughout the season. The 2008 lighting logger study was performed in February of 2008, while the Kentucky lighting logger study was performed in October of 2009 (report forthcoming). Customers' lighting usage patterns shift depending on the time of day and season, while their overall lighting usage pattern remains the same. Customers' operating hours also increase depending on the season; average operating hours in the 2008 study were 3.5 hours per day, while average operating hours in the 2009 study were 2.4 hours per day. This is also reflected by the difference in the area under the curve of the loadshape.

Figure 5. Comparison of Lighting Study Loadshapes



The hours of use of CFLs are also affected by the amount customers use the fixtures where the CFLs are installed. As high use fixtures such as fixtures in living rooms or kitchens become saturated with CFLs, customers will move to installing CFLs in lower use fixtures such as those in closets or hallways, resulting in a decrease in the average hours of use of CFLs. Comparing the 2008 CFL survey results to the 2009 survey results, the percent of respondents installing at least one fixture in high use fixtures/rooms has decreased, and in many cases, the percent of customers installing CFLs in lower use fixtures has increased.

Table 10. Percent of Respondents Installing Bulbs in This Room

Basement	15.60%	18.00%	2.40%
Bathroom	25.20%	16.00%	-9.20%
Bedroom	44.90%	36.00%	-8.90%
Closet	1.20%	3.50%	2.30%
Dining Room	11.10%	7.50%	-3.60%
Garage	3.90%	6.00%	2.10%
Hallway	9.60%	15.00%	5.40%
Kitchen	31.70%	26.00%	-5.70%
Living Room	65.90%	40.00%	-25.90%
Office	7.40%	5.50%	-1.90%
Outdoor	9.90%	6.50%	-3.40%
Utility Room	2.40%	1.00%	-1.40%

Free Riders and Free Drivers

Based on survey responses, 40.74% of purchases made by those participating in the CFL survey were due to free riders, which are people that intended to purchase CFLs before learning of the program, so they took the "free ride" by using the coupons and saving money, while 25.56% of purchases were made due to free drivers: purchases made beyond initial plans.

Program Savings

The total gross savings from these surveys are 29,068 kWh/year. After adjusting for freeridership and free drivers (spillover), the total net savings are 24,657 kWh/year. The findings are described below. This results in an average savings for the program of 44.75 kwh per bulb.

Table 11. Program Savings

Metric	Result
Number of Bulbs	561
Gross kW per bulb	0.06 kw
Gross kWh per bulb	52.76 kwh
Gross therms per bulb	N/A
Freeridership rate	40.74%
Spillover rate	25.56%
Self Selection and False Response rate	N/A
Total Discounting to be applied to Gross values	15.18%
Net kW per bulb	**0.04 kW**
Net kWh per bulb	**44.75kWh**
Net therms per participant	N/A
Measure Life	5 years
Effective useful life net savings per bulb	223.75kWh

Home Profile Questions

Customers who returned CFL Coupon Redeemer and Non Redeemer surveys were asked to fill out some demographic questions, called "home profile" questions. Overall, the demographics of coupon redeemers and non redeemers were similar. Additional discussion of comparable questions can be found in the "Comparison of Survey Results" section of the report.

How would you best describe the type of home in which you live?

	Redeemers		Non Redeemers	
Detached single family	154	86.00%	39	67.20%
Apartment	1	0.60%	2	3.40%
Townhouse	5	2.80%	8	13.80%
Manufactured	4	2.20%	2	3.40%
Condominium	9	5.00%	5	8.60%
Multi-family	2	1.10%	2	3.40%
Duplex/two family	4	2.20%	0	0.00%
Total	179	100.00%	58	100.00%

In what year was your home built?

	1959 or before	1960-1979	1980-1989	1990-1997	1998-2000	2001-2007	2008 or later	Total
Redeemers	59	59	26	19	10	7	1	181
	32.6%	32.6%	14.4%	10.5%	5.5%	3.9%	.6%	100.0%
Non Redeemers	23	19	7	3	1	5	0	58
	39.7%	32.8%	12.1%	5.2%	1.7%	8.6%	.0%	100.0%

What is the approximate square footage (heated area) of your home?

	Redeemers		Non Redeemers	
Less than 500	1	0.60%	1	1.90%
500 – 999	8	4.70%	4	7.40%
1000 – 1499	41	24.00%	10	18.50%
1500 – 1999	30	17.50%	7	13.00%
2000 – 2499	32	18.70%	7	13.00%
2500 – 2999	24	14.00%	5	9.30%
3000 – 3499	14	8.20%	4	7.40%
3500 – 3999	0	0.00%	1	1.90%
4000 - or more	1	0.60%	2	3.70%

Don't know	20	11.70%	13	24.10%
Total	171	100.00%	54	100.00%

What range best describes your total annual household income?

	Redeemers		Non Redeemers	
Less then $25,000	23	13.50%	6	10.50%
$25,000 - $49,999	36	21.20%	16	28.10%
$50,000 – $74,999	21	12.40%	4	7.00%
$75,000 – $100,000	20	11.80%	4	7.00%
Over $100,000	29	17.10%	8	14.00%
Don't know	1	0.60%	1	1.80%
Prefer not to answer	40	23.50%	18	31.60%
Total	170	100.00%	57	100.00%

How many people live in your home?

	1	2	3	4	5	6	7	8 or more	Total
Redeemers	42	90	19	16	10	0	0	0	177
	23.7%	50.8%	10.7%	9.0%	5.6%	.0%	.0%	.0%	100.0%
Non Redeemers	17	24	8	3	3	3	0	0	58
	29.3%	41.4%	13.8%	5.2%	5.2%	5.2%	.0%	.0%	100.0%

Do you own or rent your home?

	Own	Rent	Total
Redeemers	169	10	179
	94.4%	5.6%	100.0%
Non Redeemers	51	8	59
	86.4%	13.6%	100.0%

Primary heating fuel?

	Electric	Gas	Oil	Propane	Other	None	Total
Redeemers	38	107	13	5	3	0	166

	22.9%	64.5%	7.8%	3.0%	1.8%	.0%	100.0%
Non Redeemers	13	38	3	0	0	0	54
	24.1%	70.4%	5.6%	.0%	.0%	.0%	100.0%

Type of heating system?

	Redeemers		Non Redeemers	
Central Furnace	127	77.90%	44	78.6%
Electric baseboard	4	2.50%	5	8.9%
Heat pump	24	14.70%	5	8.9%
Geothermal Heat pump	1	0.60%	0	0.0%
Hot water steam boiler	6	3.70%	2	3.6%
Other	1	0.60%	0	0.0%
Do not have	0	0.00%	0	0.0%
Total	163	100.00%	56	100.0%

Age of heating system in years?

	0-4	5-9	10-14	15-19	> 19	Don't know	Do not have	Total
Redeemers	32	47	35	17	27	10	0	168
	19.0%	28.0%	20.8%	10.1%	16.1%	6.0%	.0%	100.0%
Non Redeemers	17	14	7	4	10	8	0	60
	28.3%	23.3%	11.7%	6.7%	16.7%	13.3%	.0%	100.0%

Primary cooling fuel?

	Electric	Gas	oil	Propane	Other	None	Total
Redeemers	151	6	2	0	0	3	162
	93.2%	3.7%	1.2%	.0%	.0%	1.9%	100.0%
Non Redeemers	52	5	1	0	0	0	58
	89.7%	8.6%	1.7%	.0%	.0%	.0%	100.0%

Type of cooling system?

	Central air	Window / room unit	Heat pump	Geo thermal heat pump	Other	No cooling system	Total
Redeemers	130	12	22	0	0	3	167
	77.8%	7.2%	13.2%	.0%	.0%	1.8%	100.0%
Non Redeemers	46	8	6	0	0	0	60
	76.7%	13.3%	10.0%	.0%	.0%	.0%	100.0%

Age of cooling system in years?

	0-4	5-9	10-14	15-19	> 19	Don't know	Do not have	Total
Redeemers	39	51	33	22	16	5	4	170
	22.9%	30.0%	19.4%	12.9%	9.4%	2.9%	2.4%	100.0%
Non Redeemers	20	17	5	6	7	4	1	60
	33.3%	28.3%	8.3%	10.0%	11.7%	6.7%	1.7%	100.0%

Comparison of Survey Results

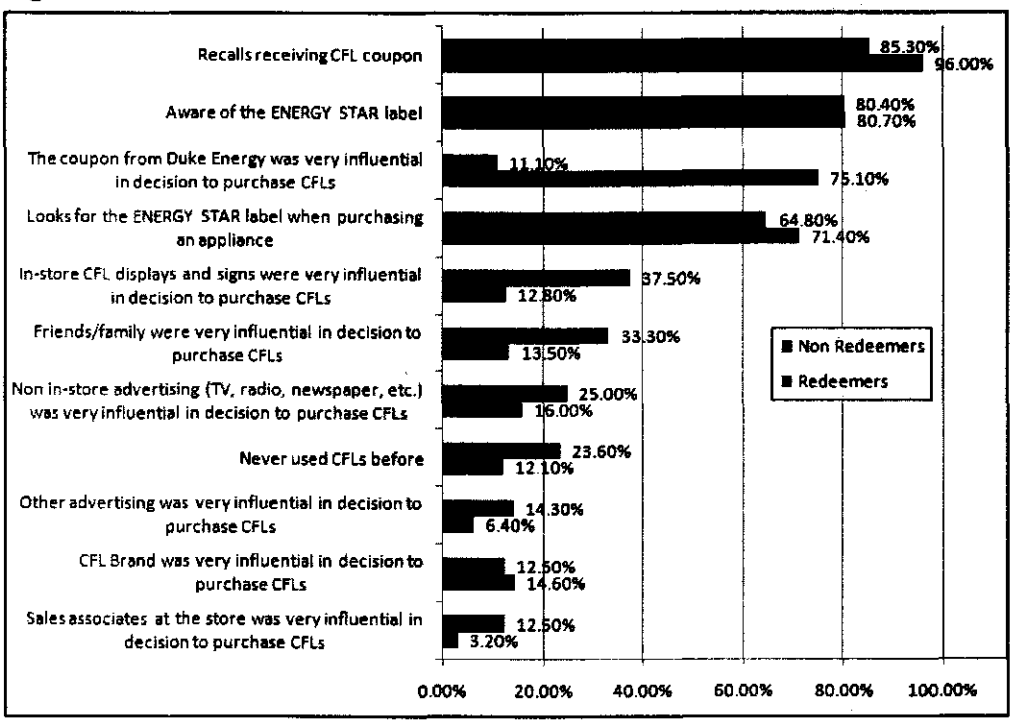
This section of the report presents the results of portions of the surveys that are directly comparable. The following figures show results from those that redeemed CFL coupons and those that did not.

Promotional Information

The figure below shows the percent of responders that are aware of the ENERGY STAR label, their lack of experience with CFLs, and what promotional materials were very influential in their decision to purchase CFLs.

Unlike in previous Duke Energy CFL program surveys, the non redeemers are not more likely to be aware of the ENERGY STAR label or to look for the ENERGY STAR label when purchasing an appliance than the redeemers. However, non redeemers were more likely to be influenced by advertising, such as in-store displays, friends/family, or other types of advertising, in their decision to purchase CFLs (in this case without using a Duke Energy coupon). This suggests that non redeemers may need additional influence besides the Duke Energy coupon in order to be motivated to purchase CFLs.

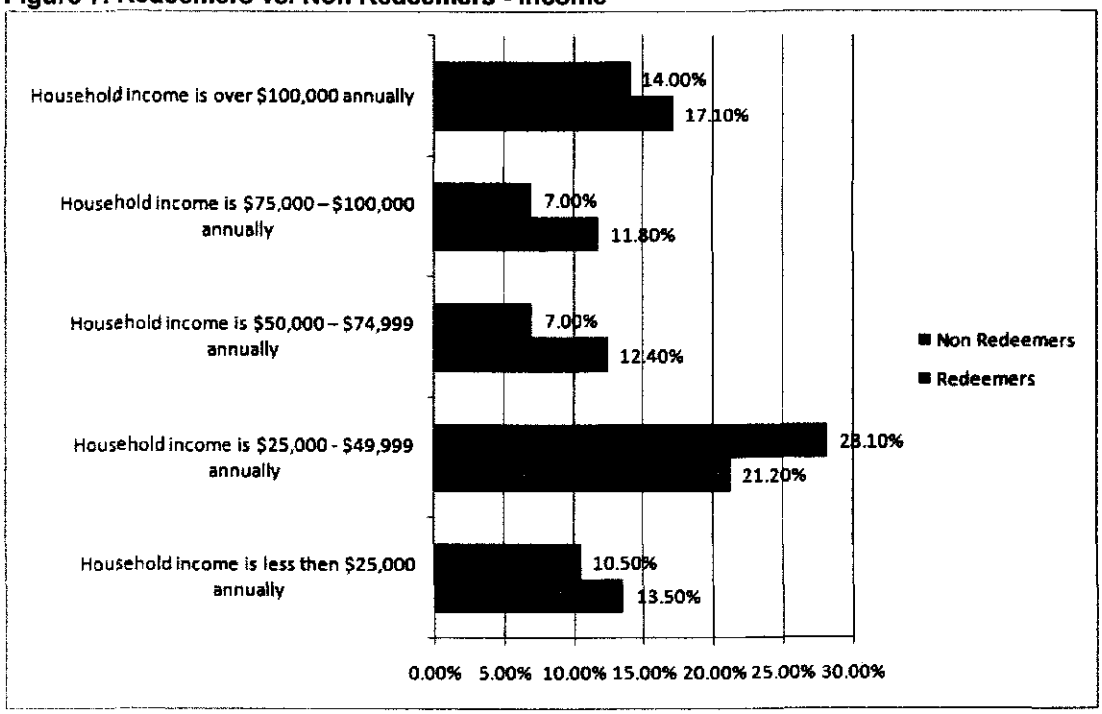
Figure 6. Redeemers vs. Non Redeemers - Promotional Information



Income

Income does not have much of an impact on whether customers redeem Duke Energy coupons, although more redeemers fall into the low and high income ranges than do non redeemers.

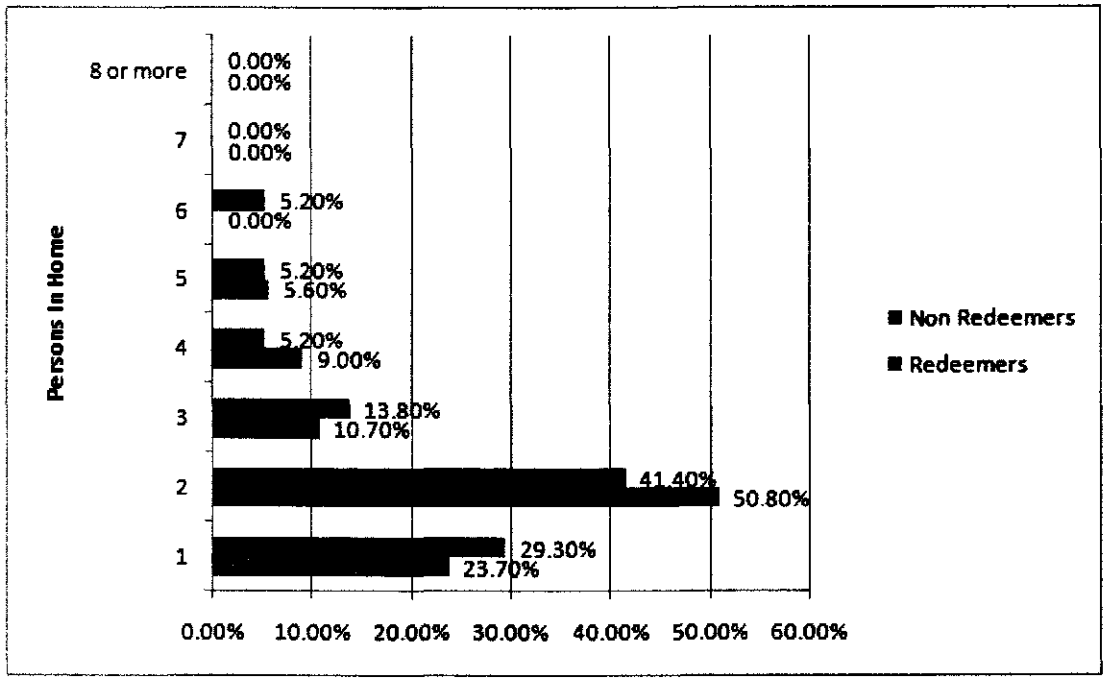
Figure 7. Redeemers vs. Non Redeemers - Income



Number of Occupants

Similarly to previous Duke Energy CFL program surveys, the number of occupants in the home does not distinguish between CFL coupon redeemers and non redeemers.

Figure 8. Redeemers vs. Non Redeemers - Occupants



Comparison of Results Across Other States

Overall, it is very difficult to compare different utilities' CFL programs across the U.S. due to large differences in population density, program types, marketing approaches, delivery methods, reporting formats, and recorded metrics, among other factors. The following is a summary of findings and an attempt to relate those programs with comparable savings figures. The list of utilities and programs used for comparison can be found in Appendix E: Data used for comparison of other states' savings:

There are three separate utilities from California represented in the list in Appendix F. There is a huge disparity in reported savings (from 61,425 to 536,939,370 kWh annually) which is a result of differences in program size. The latter number was reported by PG&E. In 2001, they were able to enlist the help of over 400 different retail locations. All told they gave rebates to about 1.35 million customers for over seven million CFLs for a per-bulb savings of approximately 76 kWh annually. They boast that there were more CFLs sold in California in 2001 than in the entire U.S. in 2000. One major reason that they were able to be so successful is their eligible population of approximately 4.5 million residential and small business customers.

The second most successful program in terms of kWh saved occurred outside the U.S. owing to Ontario Power Authority in Ontario, Canada. They redeemed over 2.7 million CFL coupons and delivered 500,000 CFLs door to door. They reported and verified savings of 132 million kWh through their Every Kilowatt Counts program in 2007 putting their per-bulb savings at 41 kWh. In third place on the list are Nevada Power and Sierra Pacific Power from Nevada. They managed to sell over two million CFLs for a first year savings of 116 million kWh and a per-

bulb savings of 58 kWh through their residential lighting program. In fourth place is the New Jersey Board of Public Utilities, which reported savings of 57,884,000 kWh but did not report the total number of CFLs rebated.

Apart from these giants, there were many other utilities that reported much more attainable kWh savings; all can be seen in Table 1 in descending order. It is by no means an exhaustive list, merely a cross-section. Connecticut and Illinois utilities have programs that reported savings around seven million kWh. Connecticut Municipal Electric Energy Cooperative's program utilized CFL distribution, CFL direct install programs, and CFL school fundraisers while Illinois Department of Commerce and Economic Opportunity was a standard rebate program; they rebated 107,432 bulbs in 2004, the year they reported seven million kWh savings, yielding a per-bulb savings of 65 kWh. The Wisconsin Department of Administration: Division of Energy, through a very similar rebate program, rebated almost the same amount, 105,538 bulbs from 2001 to 2003, but only reported savings of 5,377,372 kWh, or 51 kWh per bulb. AmerenUE reported approximately half of the savings as the Wisconsin program. Likewise, they reported rebating approximately half the number of bulbs: 49,047 bulbs rebated and 2,505,837 kWh saved in 2003, generating the same per-bulb savings of 51 kWh.

Table 12. Annual kWh savings per program

Utility	Annual kWh	per-bulb kWh
Pacific Gas & Electric	536,939,370	76
Delta-Montrose Electric Association / Intermountain Energy	219,000	73
Illinois Department of Commerce and Economic Opportunity	7,000,000	65
Nevada Power and Sierra Pacific Power	116,000,000	58
Wisconsin Department of Administration, Division of Energy	5,377,372	51
AmerenUE	2,505,837	51
Duke Energy	**29,068**	**45**
Ontario Power Authority	132,000,000	41
Connecticut Municipal Electric Energy Cooperative	7,668,000	32
New Jersey Board of Public Utilities	57,884,000	30

Some reports on market characterization were also looked at. These reports did not mention savings, but rather detailed changes in CFL consumption behaviors and pricing. The Northwest Energy Efficiency Alliance had a program in Idaho, Montana, Oregon, and Washington with the goal of increasing CFL sales in the region from 750K to 1 million annually, reaching total sales of 10.8 million by 2009. They reached their goal three years early, in 2006. They also saw the total 2008 CFL sales reach 24.7 million, a 36% increase from 2007. A different but similar study on CFL availability in the states of Maine, New Hampshire, Rhode Island, and New York, showed the total number of CFLs available shoot up from 31,000 in the spring of 2005 to over 200,000 in the fall of 2006.

The two aforementioned market characterization studies also collected data for and reported on the pricing of CFLs. The first found little to no change in average CFL price from 2006 to 2008

as well as little to no difficulty from suppliers to supply the market. The second observed a decrease in prices over the same time period. A further study was launched in Massachusetts in 2008 to collect data on incandescent bulbs and CFLs, comparing prices and incremental costs. They found that one lumen adds only $0.002 to the cost of a CFL. The incremental cost of each type of bulb can be seen in Table 2.

Table 11: Incremental cost per bulb type

Bulb Type	Incremental Cost
Flood bulb	$3.15
A-bulb	$1.74
Bullet bulb	$2.78
3-way bulb	$2.76
Bug bulb	$2.58
Globe bulb	$2.27
Candelabra Bulb	$1.54

Appendix A: CFL Coupon Redeemer Survey

Duke Energy.

Survey T. Est
123456 Does This Layout Work Rd.
Seems Like It Is. OK 55555

Dear Customer,

Duke Energy is continuously trying to improve our services for you. To help us improve the **Compact Fluorescent Light bulb** program, we would like your input. Please let us know what you think about the compact fluorescent light bulbs (CFLs) you purchased through our coupon promotion. Some examples of CFLs are in the pictures below. If you have any questions, please contact Duke Energy at mresearch @ duke-energy.com.

WE WOULD LIKE YOUR OPINION ABOUT OUR COMPACT FLUORESCENT LIGHT BULB (CFL) COUPON PROGRAM. PLEASE FILL IN THE CIRCLES COMPLETELY USING BLUE OR BLACK INK.

Do you recall receiving Compact Fluorescent Light bulb (CFL) coupons from Duke Energy? ○ Yes ○ No

Did you give away any of your coupons to someone else to use? ○ Yes ○ No

Did you use at least one coupon yourself? ○ Yes – Continue this survey ○ No – Thank you. Please return survey.

How influential were the following in your decision to purchase CFL(s)?

	Very Influential	Somewhat Influential	Not at all Influential
The coupon from Duke Energy	○	○	○
In-store CFL displays and signs	○	○	○
Non-in-store advertising (TV, radio, newspaper, etc.)	○	○	○
Sales associates at the store	○	○	○
CFL Brand	○	○	○
Other advertising	○	○	○
Friends or family	○	○	○

At which store did you purchase your CFL bulbs using the Duke Energy coupons? _____

Did you purchase any of the following items at the same time you purchased the CFLs with the Duke Energy coupons? Mark all that apply.

○ Wall or ceiling insulation ○ Faucet aerators ○ Low flow showerhead ○ Weatherstripping
○ Caulking ○ Electric wall outlet gaskets ○ Programmable thermostat ○ None of these

In this section of the survey, we would like to understand how you have used the CFL packs you purchased with the coupon(s).

	0	1	2	3	4	5	6	7-11	12+
How many CFL bulbs did you purchase in TOTAL with the Duke Energy coupon(s)?		○	○	○	○	○	○	○	○
How many CFL bulbs would you have bought if you had not had the Duke Energy coupon(s)?	○	○	○	○	○	○	○	○	○
How many CFL bulbs have you since purchased without Duke Energy coupons?	○	○	○	○	○	○	○	○	○

Of the CFLs you bought with the Duke Energy coupons:

	0	1	2	3	4	5	6	7-11	12+
How many CFLs are now installed?	○	○	○	○	○	○	○	○	○

For each CFL purchased with coupons that is now installed, please write in WHERE each CFL was installed, WHAT wattage the CFL is, WHAT wattage the old bulb was, and on average, HOW MANY HOURS you use that light each day.

	WHERE CFL INSTALLED	CFL WATTAGE	OLD BULB WATTAGE	HOW MUCH LIGHT IS USED (Hours Each Day)
Example	Living Room Floor Lamp	13Watt CFL	60Watt Incandescent	6 Hours Per Day (average)
Example	Hallway Ceiling Fixture	15Watt CFL	20Watt CFL	1 Hour Per Day (average)
Bulb 1				
Bulb 2				
Bulb 3				
Bulb 4				
Bulb 5				
Bulb 6				
Bulb 7				
Bulb 8				
Bulb 9				
Bulb 10				
Bulb 11				
Bulb 12				
Bulb 13				
Bulb 14				
Bulb 15				

Have you changed the hours of use of any fixture in which you installed the CFLs? ○ Yes ○ No

If you answered yes, how did your average usage change? ○ Increased usage ○ Decreased usage

Have you removed any of the CFLs you installed? ○ Yes ○ No

	1	2	3	4	5	6	7-11	12+
If yes, how many did you remove?	○	○	○	○	○	○	○	○

Why did you remove them?

○ Not bright enough ○ Did not like the light ○ Too slow to start
○ Burned out ○ Not working properly ○ Other

If other, please specify:_____

Did you have any CFLs installed in light sockets in your house before you bought the CFLs with the Duke Energy coupon? ○ Yes ○ No

	1	2	3	4	5	6	7-11	12+
If yes, about how many were already installed?	○	○	○	○	○	○	○	○

How long have you been using CFL light bulbs?

○ Never purchased a CFL until now ○ 1 year or less ○ 1 to 2 years ○ 2 to 3 years
○ 3 to 4 years ○ 4 or more years

	Very Satisfied	Somewhat Satisfied	Not at all Satisfied
Overall, how satisfied are you with the Duke discounted CFLs?	○	○	○

	Often	Sometimes	Never
Do you use the Duke Energy Website?	○	○	○

Have you added any major electrical appliances to your home in the past year?	○ Yes	○ No
Are you aware of the ENERGY STAR label?	○ Yes	○ No
Do you typically look for the ENERGY STAR label when purchasing an appliance?	○ Yes	○ No

Do you typically buy appliances with the ENERGY STAR label? ○ Yes ○ Some of the time ○ Never

CFL Purchasing

Considering future CFL purchases, how many CFL bulbs would you purchase in the next year if…

	0	1-2	3	4	5	6	7-11	12+
They were the same price as a standard bulb?	○	○	○	○	○	○	○	○
They were $1.00 more than standard bulbs?	○	○	○	○	○	○	○	○
They were $2.00 more than standard bulbs?	○	○	○	○	○	○	○	○
They were $3.00 more than standard bulbs?	○	○	○	○	○	○	○	○
They were free but you had to mail in a rebate form to get your money back?	○	○	○	○	○	○	○	○

General Information About Your Home

How would you best describe the type of home in which you live?

○ Detached single-family ○ Townhouse ○ Condominium ○ Duplex 2-family
○ Apartment ○ Manufactured home ○ Multi-Family (3 or more units)

In what year was your home built?

○ 1959 or before ○ 1960 - 1979 ○ 1980 – 1989 ○ 1990 - 1997
○ 1998 – 2000 ○ 2001 – 2007 ○ 2008 or later

What is the approximate square footage (heated area) of your home?

○ Less than 500 ○ 500-999 ○ 1,000-1,499 ○ 1,500-1,999
○ 2,000-2,499 ○ 2,500-2,999 ○ 3,000-3,499 ○ 3,500-3,999
○ 4,000 or more ○ Don't know

What range best describes your total annual household income?

○ Less than $25,000 ○ $25,000 to $49,999 ○ $50,000-$74,999 ○ $75,000-$100,000
○ Over $100,000 ○ Don't know ○ Prefer not to answer

How many people live in your house?

○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 or more

Do you own or rent your home?

○ Own ○ Rent

Primary heating fuel? ○ Electric ○ Gas ○ Oil ○ Propane ○ Other ○ None

Type of heating system?

○ Central furnace ○ Electric baseboard ○ Heat pump
○ Geo-thermal heat pump ○ Hot water or steam boiler ○ Other ○ Do not have

Age of heating system in years?

○ 0-4 ○ 5-9 ○ 10-14
○ 15-19 ○ 19 ○ Don't know ○ Do not have

Primary cooling fuel? ○ Electric ○ Gas ○ Oil ○ Propane ○ Other ○ None

Type of cooling system?

○ Central air conditioner ○ Window Room unit air conditioner ○ Heat pump (for cooling)
○ Geo-thermal heat pump ○ Other ○ No cooling system

Age of cooling system in years?

○ 0-4 ○ 5-9 ○ 10-14
○ 15-19 ○ 19 ○ Don't know ○ Do not have

HAVE A CHANCE TO PARTICIPATE IN THE DUKE ENERGY LIGHTING STUDY

Would you be interested in participating in a lighting study in July and August 2009?

A Duke Energy representative would place small lighting monitors on 4 or 5 light fixtures which would remain in place for 2 to 3 weeks. The monitors are smaller than the size of a bar of soap and help us measure how often lights are turned on and off during the week. The first 100 returned surveys indicating interest will be contacted. Eligible customers that are selected will receive $50 for participating.

If yes, you may receive a follow-up phone call about this lighting study in July.

○ **Yes, I am interested in participating. My phone number is: _____.**

○ **My address on the front page of this survey is correct.**

○ **My address is:**

_____

○ No, I am not interested in participating.

THANK YOU FOR YOUR RESPONSES

Appendix B: CFL Coupon Non Redeemer Survey

Duke Energy.

Survey T. Est
123456 Does This Layout Work Rd.
Seems Like It Is, OK 55555

Dear Customer,

Duke Energy is continuously trying to improve our services for you. To help us improve the **Compact Fluorescent Light bulb** program, we would like your input. Please let us know about your experiences with compact fluorescent light bulbs. Some examples of CFLs are in the pictures below. If you have any questions, please contact Duke Energy at mresearch@duke-energy.com. **Please return this survey by August 14, 2009.**

WE WOULD LIKE YOUR OPINION ABOUT OUR COMPACT FLUORESCENT LIGHT BULB (CFL) COUPON PROGRAM. PLEASE FILL IN THE CIRCLES COMPLETELY USING BLUE OR BLACK INK.

Section I.

Do you recall receiving Compact Fluorescent Light bulb (CFL) coupons from Duke Energy? ○ Yes ○ No

Did you give away any of your coupons to someone else to use? ○ Yes ○ No

Did you use at least one coupon yourself? ○ No – Continue this survey ○ Yes – Thank you. Please return survey.

Do you recall hearing about Compact Fluorescent Light bulb coupons from Duke Energy? ○ Yes ○ No – skip to section 2

Why did you decide NOT to use these coupons?

○ Too much hassle ○ Do not use CFLs ○ Do not shop at Wal-Mart Lowe's

○ Did not understand program ○ Thought there was a catch ○ Couldn't be bothered

○ Don't like CFL bulbs ○ Other _____

Did receiving the Compact Fluorescent Light bulb coupons **increase your awareness** of how you could save energy by using compact fluorescent light bulbs?

○ Yes ○ No - I was aware of the energy savings already

○ Somewhat- I was already aware, but it did help me understand their benefits better

Did the Compact Fluorescent Light bulb coupons inspire you to purchase compact fluorescent light bulbs **without** using the Duke Energy coupons? ○ No – skip to Section 2 ○ Yes - **continue**

	1	2	3	4	5	6	More than 6
If Yes, How many CFLs did you purchase **without** the coupons?	○	○	○	○	○	○	○

How influential were the following in your decision to purchase CFL(s) **without** the coupons?

	Very Influential	Somewhat Influential	Not at all Influential
The coupon from Duke Energy	○	○	○
In-store CFL displays and signs	○	○	○
Non-in-store advertising (TV, radio, newspaper, etc.)	○	○	○
Sales associates at the store	○	○	○
CFL Brand	○	○	○
Other non-Duke energy advertising	○	○	○
Friends or family	○	○	○

At which store did you purchase your CFL bulbs? _____

Did you purchase any of the following items at the same time you purchased the CFLs? Mark all that apply.

○ Wall or ceiling insulation ○ Faucet aerators ○ Low flow showerhead ○ Weatherstripping

○ Caulking ○ Electric wall outlet gaskets ○ Programmable thermostat ○ None of these

Section II.
In this section of the survey, we would like to understand how you use CFLs and other energy efficient appliances.

How many CFLs are currently installed in light sockets in your home?

0	1	2	3	4	5	6	7-11	12+
○	○	○	○	○	○	○	○	○

How long have you been using CFL light bulbs?

○ Never purchased a CFL ○ 1 year or less ○ 1 to 2 years ○ 2 to 3 years
○ 3 to 4 years ○ 4 or more years

If you have purchased CFLs, overall, how satisfied are you with the CFLs you have purchased?

Very Satisfied ○ Somewhat Satisfied ○ Not at all Satisfied ○

	Often	Sometimes	Never
Do you use the Duke Energy Website?	○	○	○

Have you added any major electrical appliances to your home in the past year? ○ Yes ○ No

Are you aware of the ENERGY STAR label? ○ Yes ○ No

Do you typically look for the ENERGY STAR label when purchasing an appliance? ○ Yes ○ No

Do you typically buy appliances with the ENERGY STAR label? ○ Yes ○ Some of the time ○ Never

CFL Purchasing

Considering future CFL purchases, how many CFL bulbs would you purchase in the next year if...

	0	1-2	3	4	5	6	7-11	12+
They were the same price as a standard bulb?	○	○	○	○	○	○	○	○
They were $1.00 more than standard bulbs?	○	○	○	○	○	○	○	○
They were $2.00 more than standard bulbs?	○	○	○	○	○	○	○	○
They were $3.00 more than standard bulbs?	○	○	○	○	○	○	○	○
They were free but you had to mail in a rebate form to get your money back?	○	○	○	○	○	○	○	○

General Information About Your Home

How would you best describe the type of home in which you live?

○ Detached single-family ○ Townhouse ○ Condominium ○ Duplex 2-family
○ Apartment ○ Manufactured home ○ Multi-Family (3 or more units)

In what year was your home built?

○ 1959 or before ○ 1960 - 1979 ○ 1980 – 1989 ○ 1990 - 1997
○ 1998 – 2000 ○ 2001 – 2007 ○ 2008 or later

What is the approximate square footage (heated area) of your home?

○ Less than 500 ○ 500-999 ○ 1,000-1,499 ○ 1,500-1,999
○ 2,000-2,499 ○ 2,500-2,999 ○ 3,000-3,499 ○ 3,500-3,999
○ 4,000 or more ○ Don't know

What range best describes your total annual household income?

○ Less than $25,000 ○ $25,000 to $49,999 ○ $50,000-$74,999 ○ $75,000-$100,000
○ Over $100,000 ○ Don't know ○ Prefer not to answer

How many people live in your home?

○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 or more

Do you own or rent your home?

○ Own ○ Rent

Primary heating fuel? ○ Electric ○ Gas ○ Oil ○ Propane ○ Other ○ None

Type of heating system?

○ Central furnace ○ Electric baseboard ○ Heat pump
○ Geo-thermal heat pump ○ Hot water or steam boiler ○ Other ○ Do not have

Age of heating system in years?

○ 0-4 ○ 5-9 ○ 10-14
○ 15-19 ○ 20 ○ Don't know ○ Do not have

Primary cooling fuel? ○ Electric ○ Gas ○ Oil ○ Propane ○ Other ○ None

Type of cooling system?

○ Central air conditioner ○ Window/Room unit air conditioner ○ Heat pump (for cooling)
○ Geo-thermal heat pump ○ Other ○ No cooling system

Age of cooling system in years?

○ 0-4 ○ 5-9 ○ 10-14
○ 15-19 ○ 20 ○ Don't know ○ Do not have

THANK YOU FOR YOUR RESPONSES

Appendix C: Smart $aver® CFL Management Interview Instrument

Name: _____

Title: _____

Position description and general responsibilities:

_____

_____

_____

We are conducting this interview to obtain your opinions about and experiences with the Smart $aver® CFLs program. We'll talk about the Smart $aver® CFLs Program and its objectives, your thoughts on improving the program, and the technologies the program covers. The interview will take about an hour to complete. May we begin?

Program Objectives

1. In your own words, please describe the Smart $aver® CFL Program's current objectives. How have these changed over time?

2. In your opinion, which objectives do you think are best being met or will be met?

3. Are there any program objectives that are not being addressed or not being addressed as well as possible or that you think should have more attention focused on them? If yes, which ones? How should these objectives be addressed? What should be changed?

4. Should the program objectives be changed in any way due to technology-based, market-based, or management based conditions? What objectives would you change? What program changes would you put into place as a result, and how would it affect the operations of the program?

Operational Efficiency

5. Please describe your role and scope of responsibility in detail. What is it that you are responsible for as it relates to this program? When did you take on this role? *If a recent change in management*...Do you feel that Duke Energy gave you enough time to adequately prepare to manage this program? Did you get all the support that you needed to manage this program?

6. Please review with us how the Smart $aver® CFL Program operates relative to your duties, that is, please walk us through the processes and procedures and key events that allow you do currently fulfill your duties.

7. Have any recent changes been made to your duties? If so, please tell us what changes were made and why they were made. What are the results of the change?

8. Describe the evolution of the Smart $aver® CFL Program. How has the program changed since it was it first started?

9. Do you have suggestions for improvements to the program that would increase participation rates or interest levels?

10. Do you have suggestions for improving or increasing energy impacts?

11. Do you have suggestion for the making the program operate more smoothly or effectively?

Program Design & Implementation

12. *(If not captured earlier)* Please explain how the interactions between the retailers, customers and the Smart $aver® CFL management team work. Do you think these interactions or means of communication should be changed in any way? If so, how and why?

13. Describe your quality control and tracking process.

14. Are key industry experts, trade professionals or peers used for assessing what the technologies or models should be included in the program? If so, how does this work?

15. Are key industry experts and trade professionals used in other advisory roles? If so how does this work and what kind of support is obtained?

16. Describe the Smart $aver® CFL retailer program orientation training and development approach. Are retailers getting adequate program information? What can be done that could help improve retailer effectiveness? Can we obtain any informational materials that are being used?

17. What market information, research or market assessments are you using to determine the best target markets or market segments to focus on?

18. What market information, research or market assessments are you using to identify market barriers, and develop more effective delivery mechanisms?

19. Overall, what about the Smart $aver® CFL program works well and why?

20. What doesn't work well and why? Do you think this discourages participation or interest?

21. Can you identify any market, operational or technical barriers that impede a more efficient program operation?

22. In what ways can these operations or operational efficiencies be improved?

23. In what ways can the program attract more vendors?

24. In what ways can the program attract more consumer participation?

25. How do you make sure that the best information and practices are being used in Smart $aver CFL operations?

26. *(If not collected above)* What market information, research or market assessments are you using to determine the best target markets and program opportunities, market barriers, delivery mechanisms and program approach?

27. If you could change any one thing about the program, what would you change and why?

28. Are there any other issues or topics you think we should know about and discuss for this evaluation?

Appendix D: Smart $aver® CFL Retailer Management Instrument

Name: _____

Title: _____

Position description and general responsibilities:

_____

_____

_____

We are conducting this interview to obtain your opinions about and experiences with the Smart $aver® CFL program. We'll talk about your understanding of the Smart $aver® CFL Program and its objectives, your thoughts on improving the program, and the technologies the program covers. The interview will take about 20-30 minutes to complete. May we begin?

Understanding the Program

We would like to ask you about your understanding of the Smart $aver® CFL program. We would like to start by first asking you to…

1. Please review for me how you are involved in the program and the steps you take in the participation process. Walk me though the typical steps you take to introduce the program to the customer, and what you do to help a customer become eligible for this program. What do you do to receive or help the customer receive the program incentive?

2. What kinds of problems or issues have come up in the Smart $aver® CFL program?

3. Have you heard of any customer complaints that are in any way associated with this program? Have callbacks increased due to the program technologies?

Program Design and Design Assistance

4. Do you feel that the proper technologies and equipment are being covered through the program?

5. Are the coupon levels appropriate?

6. Are there other technologies or energy efficient products that you think should be included in the program?

7. Are there components that are now included that you feel should not be included? What are they and why should they not be included?

Reasons for Participation in the Program

We would like to better understand why retailers/distributors become partners in the Smart $aver® CFL Program.

8. How long have you been a partner in the Smart $aver® CFL Program?

9. What are your primary reasons for participating in the program? Why do you continue to be a partner?.... *If prompts are needed...* Is this a wise business move for you, is it something you believe in professionally, is it that it provides a service to your customers, or other reasons?

10. Has this program made a difference in your business? How? Are your primary reasons for participation being met? Why/why not?

11. How do you think Duke can get more distributors/retailers to participate in this program?

Program Participation Experiences

The next few questions ask about the process for participation.

12. Do you think the process could be streamlined in any way? How?

13. Do you have the right amount of materials such as information sheets, brochures or marketing materials that you need to effectively show and sell the CFLs covered by the coupons? What else do you need?

14. Overall, what about the Smart $aver® CFL Program do you think works well and why?

15. What changes would you suggest to improve the program?

16. Do you feel that communications between you and Duke's program staff is adequate? How might this be improved?

17. What specific benefits do you receive as a result of participating in Duke's Smart $aver® CFL Program or from selling Smart $aver® CFLs?

18. What do you think are the primary benefits to the people who buy Smart $aver® CFLs?

19. Are there other benefits that are important to a potential customer? What are these?

Market Impacts and Effects

21. How do you make customers aware of the CFL Program?

22. What percent of the customers are already aware of the program before you present it to them? What percent of the customers take advantage of the program after you present it and explain it to them?

23. Are customers more satisfied with this equipment? Why or why not?

24. Do you market or sell the Smart $aver® CFL differently than your other products? How?

25. What percent of your customers end up buying the CFL instead of an incandescent because of the coupon?

Recommended Changes from the Participating Contractors

27. Are there any other changes that you would recommend to Duke Energy for their Smart $aver® CFL Program that we have not already discussed?

28. If you could make any changes you wanted to the CFL program, what would you do differently?

Standard Practice vs. Smart $aver® CFL Practices

We would like to know what your presentation and sales practices were before your involvement in the Smart $aver® CFL program, and how you would offer your products without the program.

29. If the program were to be discontinued, would you still offer the CFLs? If yes, would you structure pricing differently? If yes, how?

30. How did the Smart $aver® CFL program change how you present and sell energy efficient light bulbs?

31. In your opinion is the Smart $aver® CFL program still needed? Why?

Appendix E: Data used for comparison of other states' savings

State: California
Utility: Pacific Gas & Electric
Program: Upstream Residential Lighting Program
Summary: Instant discount program
Contact: Terrance Pang, Sr. Program Manager, 415-973-8971, txp3@pge.com
Link: http://www.aceee.org/utility/6cpgereslight.pdf
Impacts:
- Annual savings = 536,939,370 kWh
- Peak demand savings = 140,598 kW

Other: As many as 1.35 million customers

State: California
Utility: Alameda Municipal Power
Program: CFL promotions
Summary: Rebate program
Contact: N/A
Link: http://www.alamedamp.com/aboutus/PUB%20Reports%202009/0509/09-0518_7.A.%20FINAL%20General%20Manager%27s%20Report%20April%202009.pdf
Impacts:
- Gross savings = 61,425 kWh
- Greenhouse gas reduction = 43,575 lbs. CO_2

Other: Savings are as of April 30, 2009

State: California
Utility: Pasadena Water and Power
Program: Residential CFL distribution
Summary: Distribution of packs of CFLs
Contact: N/A
Link: http://www.fypower.com/pdf/BPG_LGov5_LowIncome.pdf
Impacts:
- Annual energy savings = 3,068,016 kWh

Other: Summer of 2001

State: Connecticut
Utility: Connecticut Municipal Electric Energy Cooperative
Program: Residential Efficient Products: Lighting
Summary: CFL distribution, CFL direct install programs, CFL school fundraisers
Contact: N/A
Link: http://ase.org/uploaded_files/5686/super_nova/Connecticut%20Municipal%20Electric%20Energy%20Cooperative%20%28CMEEC%29.pdf
Impacts:
- Annual energy savings = 7,668 MWh
- Lifetime savings = 53,683 MWh
- kW impact = 604

Other: For the year 2008

State: Idaho, Montana, Oregon, Washington
Utility: Northwest Energy Efficiency Alliance
Program: N/A
Summary: Implementation of CFL programs in large retail chains as well as smaller commercial locations
Contact: Jennifer E. Canseco, KEMA, Tami Rasmussen, KEMA, Anu Teja, NEEA
Link: 2009 IEPEC "A Market Transformed: But will the Impacts be Sustained?"
Impacts:
- Goal was to increase CFL sales in region from 750K to 1 million annually, reaching total sales of 10.8 million by 2009-reached goals in 2006

- Total 2008 CFL sales reached 24.7 million, a 36% increase from 2007

Other:

- Little to no change in average CFL price from 2006 to 2008, little to no difficulty from suppliers to supply the market
- Of CFL manufacturers and retail reps interviewed in support of the study, about 1/2 reported that NEEA's withdrawal from the incentive market had no affect on their 2008 CFL sales; nearly all of the other half reported losses minimized or entirely supplanted by revenue from specialty lamp and non-rebated lamp sales

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State: Illinois
Utility: Illinois Department of Commerce and Economic Opportunity
Program: National change a light change the world promotion
Summary: Instant rebate program
Contact: N/A
Link: http://www2.illinoisbiz.biz/StatutoryMandatedReports/07252006-2005EETRUSTFUNDREPORTwithattachment.pdf
Impacts:

- 2003: 56,445 bulbs and over 3.7 million kWh
- 2004: 107,432 bulbs and over 7 million kWh
- Lifetime savings = over 75 million kWh

Other: From January 2003 to December 2004

State: Maine, New Hampshire, Rhode Island, New York
Utility: N/A
Program: N/A
Summary: Collected data on CFL sales/types/availability in large retail chains and smaller locations
Contact: Seth E. Craigo-Snell, Ph.D., Applied Proactive Technologies, Inc., Springfield, MA
Link: N/A
Impacts:

- Total number of CFLs available: Spring 2005: 31,000, Fall 2008: 185,000+, max: Fall 2006: 200,000+
- Strong growth for bare spirals: Spring 2005: 100/location, Fall 2008: 525/location
- Specialty CFL growth: 30/ location to 100+/location in same period

Other:

- Bare spiral CFLs accounted for minimum of 3/4 of all CFLs on market during study
- Overall, prices have generally decreased from 2005 to 2008 on both bare spiral as well as specialy CFLs

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State: Massachusetts
Utility: N/A
Program: Massachusetts ENERGY STAR Lighting Program
Summary:

- Data collected from lighting product retailers in early 2008 in Massachusetts
- Data was collected on incandescent bulbs and CFLs comparing prices, incremental costs, and the affects of multi-pack vs. single pack and specialty CFLs vs. bare spiral
- Regression analysis performed from data

Contact: Greg Clendenning, Nexus Market Market Research, Inc., Arlington, VA; Lynn Hoefgen, Nexus Market Research, Inc., Cambridge, MA; Angela Li, National Grid, Northborough, MA; Gail Azulay, NSTAR, Boston, MA
Link: N/A
Impacts: N/A
Other:

- One lumen adds 0.002 to the cost of a CFL
- A flood bulb adds $3.15 to the cost of a CFL
- An A-bulb adds $1.74 to the cost of a CFL
- A bullet or torpedo bulb adds $2.78 to the cost of a CFL
- A 3-way bulb adds $2.76
- a bug bulb adds $2.58
- a globe bulb adds $2.27
- a candelabra bulb adds $1.54

- CFLs sold at Home Depot, Wal-Mart and Ace Hardware are $0.58, $0.84 and $1.22 less expensive than comparable CFLs sold elsewhere, while CFLs sold at grocery stores are $0.82 more expensive than elsewhere

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State: Missouri
Utility: AmerenUE
Program: Change a Light Rebate Program
Summary: Instant rebate coupons, product markdown efforts, and customer education efforts
Contact: N/A
Link: http://74.125.95.132/search?q=cache:sQIn0nDoJ8EJ:www.icc.illinois.gov/e-docket/reports/view_file.asp%3FintIdFile%3D219110%26strC%3Dbd+EVALUATION+oF+AMERENUE%E2%80%99S+CHANGE+A+LIGHT+REBATE+PROGRAM&cd=1&hl=en&ct=clnk&gl=us
Impacts:
- 2003: 49,047 bulbs and 2,505,837 kWh
- 2004: 47,056 bulbs and 2,380,377 kWh
- 2005: 39,635 bulbs and 1,979,533 kWh
- Lifetime savings = 79,831,392 kWh

Other: N/A

State: Nevada
Utility: Nevada Power and Sierra Pacific Power
Program: Residential CFL
Summary: Buy one get one free offer
Contact: Robert Balzar, Nevada Power
Link: http://www.swenergy.org/programs/nevada/127.pdf
Impacts: Electricity savings = 1.85 GWh/yr
Other: During Spring 2003

State: Nevada
Utility: Nevada Power and Sierra Pacific Power
Program: Residential Lighting Program
Summary: Community education/outreach, CFL change-out events at non-profit organizations, promotional displays and showcasing events at retailers
Contact: Robert Robertson, Ecos, Portland, OR; John Hargrove, Sierra Pacific Power, Reno, NV
Link: N/A
Impacts:
- 2006: 1,026,797 CFLs sold generating 62,335,632 kWh savings
- 2007: About 2 million CFLs sold generating over 116 GWh of first year savings

Other: The percentage of residential sockets with energy efficient lighting has risen from 0.833% in 2003 to 7.35% in 2007 from program efforts

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State: New Jersey
Utility: New Jersey Board of Public Utilities
Program: Energy Star Products Program – Lighting
Summary: N/A
Contact: N/A
Link: http://www.njcleanenergy.com/files/file/Library/E-STAR%20Products%20CFL%20Evaluation%20Report%20-%20Draft%20July%209%202009.pdf
Impacts:
- 2004: Energy savings = 57,884 MWh; Peak demand savings = 15.7 MW
- 2005: Energy savings = 37,933 MWh; Peak demand savings = 8.7 MW

Other: N/A

State: New York
Utility: Long Island Power Authority
Program: N/A
Summary: Three separate promotions, using paper coupons as well as store mark downs. CFLs were discounted $1 per bulb

Contact: Stacey Wagner, 631-436-5765, Swagner@keyspanenergy.com
Link: N/A
Impacts:
- 2004: 260,874 ENERGY STAR CFLs rebated
- 2005: 468,497 ENERGY STAR CFLs rebated

Other: N/A

State: Ontario, Canada
Utility: Ontario Power Authority
Program: Every Kilowatt Counts Program
Summary: Coupons
Contact:
Link: http://www.powerauthority.on.ca/Storage/96/9130_2007_Conservation_final_results_report_final_March_3-09.pdf
Impacts:
- Summer demand savings: 4.9 MW
- First year energy savings: 132 GWh
- Lifetime energy savings: 1,060 GWh

Other: 2,773,186 coupons redeemed between spring and fall 2007

State: Wisconsin
Utility: Wisconsin Department of Administration, Division of Energy
Program: Focus on Energy Program
Summary: Instant and mail-in rebates
Contact: N/A
Link: http://www.epa.gov/RDEE/documents/WI_3rd_Party_MV_PA_Report.pdf
Impacts: 105,538 bulbs, 81,475 installed, 5,377,372 kWh saved
Other: From 2001 to 2003

State: California
Utility: Itron
Program: Express Efficiency Program
Summary: Rebates for buying efficient equipment
Contact: John Cavalli, Itron
Link: http://74.125.95.132/search?q=cache:VPjF9CH4EswJ:www.calmac.org/events/2_Express_Efficiency_Itron.ppt+2003+express+efficiency+program+evaluation+itron&cd=3&hl=en&ct=clnk&gl=us
Impacts:
- 2000: 14,046 kWh
- 2001: 41,223 kWh
- 2002: 39,985 kWh
- 2003: 31,075 kWh

Other: N/A

State: N/A
Utility: Delta-Montrose Electric Association and Intermountain Energy
Program: N/A
Summary: Light bulb fundraiser, DMEA program to engage community organizations
Contact: Ed Thomas, Market Development Group, 970-207-8347, ethomas@marketdevelop.com
Link: N/A
Impacts:
- Over $5,400 in net power purchase savings for DMEA project for first year alone
- Over 219,000 kWh saved annually by DMEA members
- Over 2,200 kW saved in avoided power demand charges
- 139 metric tons of carbon emissions reductions

Other: 3,044 bulbs sold during first 2 weeks of October 2005

Appendix F: Effective Useful Life Adjustment Factor for Installed CFLs

The energy savings calculated in this study use a reduced effective useful life (EUL) for the program-incented CFLs instead of the period advertised by the manufactures. The reduction in the EUL is consistent with the results of the EUL of CFLs used in switched environments representative of the typically residential in-door installations. The adjustment used in this report is 0.523 of the advertised EUL for the installed bulbs. This adjustment is presented in the Excel spreadsheet table below for each of the rooms in which the bulbs have been reported to be installed by the customers and the adjusted hours of use of those bulbs as indicated by the Duke Energy lighting logger study.

It is anticipated that this adjustment may be less dramatic in the future as additional studies of newly manufactured (more reliable technologies) bulbs are conducted, if the newer generation of CFLs are less impacted by in-house switching behaviors. However, at this time, the results of the California DEER Effective Useful Life Study and other research (see references below) indicate that advertised EULs are about twice what can be expected from the CFLs once installed in homes and turned on and off consistent with typical applications.

Room	Self Reported	Actual Daylength Adjusted	Difference (Self Rep - Actual)	%	Weight (from # of self reports)	Weighted Percentages	wt * actual hours
Basement	3.157	2.681	0.475	17.77%	0.104222	1.85%	0.279419182
Bathroom	2.27	0.877	1.393	158.84%	0.097625	15.51%	0.085617125
Bedroom	2.134	1.955	0.18	9.19%	0.216359	1.99%	0.422981845
Den	4	0.685	3.315	483.54%	0.015831	7.66%	0.010844235
Dining Roo	1.76	2.538	-0.778	-30.65%	0.040897	-1.25%	0.103796586
Entryway	1.167	2.099	-0.932	-44.42%	0.011873	-0.53%	0.024921427
Garage	1.289	1.105	0.185	16.71%	0.025066	0.42%	0.02759793
Hallway	2.368	3.522	-1.154	-33.04%	0.067282	-2.22%	0.236967204
Kitchen	4.735	3.415	1.319	38.63%	0.151715	5.86%	0.518106726
Living Roo	3.622	3.85	-0.228	-5.92%	0.242744	-1.44%	0.9345644
Office	3.254	9.961	-5.707	-63.48%	0.022427	-1.42%	0.201865427
Stairway	3.5	0.538	2.962	550.99%	0.003958	2.18%	0.002129404
			Average	91.52%	0.999999	28.60%	2.64891149

EUL = Rated Life of Lamp (10000 hours) * Switching Degredation Factor (indoor only) / Annual usage

rated life	10000
Hr/day	2.85
hr/yr	1040.25
adj facto	0.523

Rated life varies from 8000 (Lowes) to 12000 (Wallmart) Use average of 10000

Wt average from table above

From California DEER EUL study

References:

www.deeresources.com (California's deemed database and database resource site, CFL EUL multiplier for in-door residential applications).

Proceedings of the ACEEE Summer Study, 2008, *The Dark and the Bright: Effectiveness Issues for CFL Programs*, Corina Jump, Jane Peters, Dulane Moran, James Hirsh, Shahana Samiullah,

The Smart Building Advantage Program

A Presentation of Customer Interview Results

Prepared for Duke Energy Corporation

526 South Church Street
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March 1, 2011

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The Focus of this Evaluation

This evaluation is the first of a three-part assessment of the Smart Building Advantage Pilot program. In this (first) assessment, the evaluation looks at the reasons for participation, the value proposition for the participating customers, and the ways in which the program is meeting the needs of these early participants. The second evaluation will examine the program's operations after participants have had enough experience with the program and have implemented the recommended strategies. This second study will assess the program's operations as well as the participants' experience with the program, the recommended actions, and the savings that they are experiencing. The third evaluation, to be completed and reported at the same time as the second study, examines the energy impacts that have been achieved by the participants as a result of their participation.

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Executive Summary

Participants like the Smart Building Advantage (SBA) program. All SBA participants view this program as not only a service that helps them control their electric consumption and the associated costs, but also as a way for them to gain needed experience with the equipment and strategies that will help them make the adjustment to an hourly energy price and supply condition. Participants view this program as a way to become more prepared for managing the energy future of their companies. It is more than a utility program to these customers; it is an educational and strategic capacity building exercise.

The program is also mission-friendly for these key account customers. All of the interviewed participants expressed a corporate objective focused on moving toward or continuing to move toward a greener operational platform. However, cost control within that platform is important and is their key focus. This program helps them move in both directions. The technical assessment conducted by a nationally recognized energy management expert, who does not represent any brand or equipment trademark, is a key benefit of the program's design. This single aspect helped to build trust in the recommendation and helped key decision makers believe that the expected savings are real and can be expected to materialize. Linking the program to any single equipment supplier or type of brand equipment or communications platforms will harm this trust.

The SBA program strengthens key account customer relationships with Duke Energy and helps move Duke Energy to a position of being a valued trade partner rather than just an energy supplier. Participants report that they would not have made the degree of improvements that they are making without establishing trust in the results of the energy analysis. Participants must be able to trust that Duke Energy is placing their needs above other concerns, and they must be able to rely on the financial support the program provides. These conditions allowed participants to move forward with their projects. All participants value the educational experience they have gained as a result of their participation, but particularly value the knowledge gained regarding building energy management approaches and their integration with operations in a way that is not disruptive to their operations.

All of the key-account commercial participants, regardless of their position or level of responsibility, view this program as a good thing for them personally and for their company, and look forward to replicating this experience in the future, if the projected savings are obtained.

Managers report that the program is set up to synchronize with their management and decision systems to a large degree, but also suggest more attention is needed on this aspect of the program. Participants report that Duke Energy and their program contractors are thorough, responsive, courteous, and focused on creating a win-win participation experience. However, participants noted that their operational decision systems are set up to operate on a schedule beyond a program year, or beyond a Duke Energy designed participation window. Some participants referred to a multi-year planning horizon for key corporate decisions of the magnitude of the program's

recommendations and their associated costs. Participants agreed that longer term planning is important for integrating higher cost retrofits into their corporate planning cycles. In multiple cases, the participants were able to move the decision process up the corporate ladder faster than what is typical, but also noted that these are special case pilot test circumstances. Participants noted that capital equipment upgrades of the magnitude recommended by the program will require integration within their longer term financial plans and approval processes. This means that Duke Energy's program managers will need to plan for these longer cycles within their operational designs as they consider moving from a pilot phase to an operational phase. Several of the pilot participants suggested working together to create 2, 3, 4, and 5 year plans for equipment upgrades. However, these participants also want to make sure that the projected energy savings are real before they move too far. The future success of the program, especially for these early pilot participants, rests on the amount of and speed of the savings projected.

Participants view the program as a good way to test the Smart Grid waters, with Duke Energy as a partner to help. These large key account customers are not sure what Smart Grid is, how it will work, or what it means to their cost of business. An energy management approach that might erode profits or increase costs is not an option for these customers. These participants see risks with Smart Grid; however, they are not sure of what those risks are, or the size of the risks. None of the participants expressed a desire for a "wait and see" strategy. That is, they do not want to wait until they are harmed, and they want to make sure that they have the ability to manage their risk and to avoid being harmed by lack of preparedness. All participants noted that having Duke Energy as a business partner in this endeavor is critical to their perceived ability to not only effectively manage risks, but to help them place themselves in a position of being able to control the decisions that help them capitalize on Smart Grid. Participation is an energy management and building control strategy.

All participants, in different ways, noted the ability of the program to help them become more competitive or place them in a better market position compared to other firms that do not know how to use energy and energy control systems well. For some customers, environmental performance is important because it may impact their ability to acquire and keep tenants and customers. These companies want an environmental friendly image that is backed up by performance.

A key consideration in the participation decision was uninterrupted operations. Most interviewees noted that the smooth maintenance of their operations, regardless of what that means, is important. For some customers it meant being able to use the facilities as needed - with flexible use schedules. For others it meant that occupants would not be interrupted or inconvenienced, or that core services would be un-impacted. While all participants understand that there is a need to shut down, remove, reconfigure, or install new equipment and control systems, all interviewees indicated that these must be planned and implemented in a way that eliminates or minimizes disruptions. At the time these interviews were conducted for this evaluation, the participants were pleased with the way the process was performing given this objective. But several reserved the right to make this judgment as the project moves forward.

Participants are cost conscience. Cost of operations and the return on the investment compared to other internal corporate needs is just as important as purchase price. All participants noted that acquisition costs are a barrier. However, they also noted that the Duke Energy incentive was a critical part of their decision to move forward. In all cases, these projects would not have been done without the Duke Energy incentive and technical assistance which helped overcome hesitation or resistance to making such expensive upgrades. Even the participants who have a full-time engineering staff and who had examined similar types of retrofits and configurations in the past reported that it was the program package that allowed them to move forward when they had been unable to in the past. However, the incentive alone was not the key factor for these participants. The engineering analysis and the skills and reputation of the technical team were just as, if not more, important. Participants need to be sure the savings will be there. The future of these types of actions from these participants will depend on the performance of these pilot projects.

For all participants, the program and their experience with it has strengthened their business relationship with Duke Energy. While Duke Energy was and is a valued business partner for these customers, the experience associated with this program has made these participants inclined to want to be more closely associated with Duke Energy and they view Duke Energy as a valued strategic business partner.

Summary of the Smart Building Advantage Program

The Smart Building Advantage Pilot Program is a small pilot program that works with a limited number (4 to date) of larger commercial customers to help them control their energy demand and consumption. The program works with independent technical experts hired by Duke Energy to examine the equipment and energy control approaches at the customer's location, assess their energy and demand savings potential through the use of advanced real-time hourly energy analysis linked to real time control strategies. The program also provides incentives to update equipment, the expertise of Duke Energy technical staff to configure equipment, and equipment control strategies that can reduce energy use or demand and save money for their participants. Because of this approach each project is different, and is based on a detailed technical assessment of each building, the equipment in that building, the operation of that equipment, and the use conditions and needs of the facility. Duke Energy uses the results of the technical assessment, in conjunction with a contract with each participant to undertake specific equipment and control strategy changes to reduce demand and energy use. The results of the technical assessment and the individual agreements with each participant specifying the actions they are committing to take are used to calculate the program incentive in a way that causes those actions to be completed. The actions taken are based on the ability to understand hourly energy use and prices, and project forward what energy management strategies are needed to operate the participants' buildings. The control strategies implemented are designed to lower demand or consumption, while still meeting the needs of the building's occupants.

The program is designed to take advantage of hourly price changes so that the participant is better able to control their energy use and acquire a greater ability to control their energy demand and use costs. At the time of this evaluation, the program had four large key account commercial participants.

The evaluation results for the first study are presented in the remainder of this document.

Participants' Perception of the Program

This is a pilot program. As a result, one of the objectives of this evaluation is to better understand how participants value the program. Understanding the value proposition for these early participants will help identify areas on which program designers can focus efforts. It is important that pilot programs be evaluated in a way that addresses the needs of the customers so that program managers can be successful in delivering on these needs while capturing the needed energy savings. Success for programs as technically focused and as costly as these projects are for the participants, means that in addition to achieving Duke Energy's energy objectives, the project must perform well for the participants. This section of the report presents the results of an assessment of the value proposition for the participating customers.

Because the pilot program participants consist of four large commercial customers, we are not presenting a quantitative analysis of the value proposition findings. A quantitative analysis of such a small sample would not be informative in a way that can be directly applied to the larger commercial market. However, it is important to understand the value that participants place on different aspects of the program. In reviewing the responses to the value proposition questions asked of these participants, we have identified 12 key value areas for the four participating commercial customers. These include:

1. Cost savings and return on investments
2. Packaging the program as a complete service
3. Understanding Smart Grid
4. Getting the right people with the right focus
5. Moves customers in a direction they want to go
6. Uses the right equipment and technology
7. Focuses on the customer's needs – not the needs of vendors
8. Brings money to the table
9. Supports the customer's environmental objectives
10. Educates the customer's employees
11. Provides a competitive market advantage
12. Reduces downtime, service issues, and complaints

For confidentiality purposes the names of the participants are removed from these findings.

Cost Savings and Return on Investments

Participation in the Smart Building Advantage program and the implementation of the energy technology and control strategies needs to be cost effective. Projects must produce an acceptable return on the investment for these participants. This program appears (at this time) to meet this test. However, actual performance will be important. Participants report that performance cannot only be projected, it has to be delivered. Participants reported that they typically must see a payback of less than 3 to 4 years for

project consideration. Project approval has a tougher hurdle. Several of the participants report that any project that cannot pay back within 12-18 months is seen as a higher risk project. These participants note that projects that take more than a couple of years to reach payback are not the projects of choice if other, more profitable, projects are available. These participants report that their energy investment decisions are becoming harder to sell to senior management and new projects will need to perform better than previous projects. All of the participants reported that Duke Energy's program helped them move their projects from a non-approved status to an approved status by helping to meet their internal investment thresholds and by helping to "sell" the projects up the management chain.

Several managers noted that the rate of return for their project was a primary value contributor and represented a good investment strategy. Managers report that the return on their project investment is better than most other investment opportunities, including new products and service development. The rate of return is a primary driver of the customer's ability to move from the assessment phase to the implementation phase. However, cost saving projects that have a high rate of return do not necessarily get approved. A more important consideration for some participants is the generation of new revenue. *"Everything* [in our firm] *is based on revenue, revenue generation comes first."* However, some participants report that they have more projects to do than revenue to implement them. As a result, projects that produce new income have a higher priority than projects that reduce costs. One key decision maker reported that *"there is a built-in bias that acts to reduce interest in saving money compared to projects that generate new income."* The program's projects for these pilot customers provided enough savings that they could compete for dollars when compared to other demands for investment capital. *"The value in this project was that it provided enough return on the investment from savings that it could be approved."*

Out of pocket price reduction and cost control are important. The program provides participants with financial assistance, technical assistance, and the implementation assistance to be able to better control costs associated with demand charges and energy consumption. Cost control is a primary participation driver for these participants. For some, a key participation driver is building energy use cost control. For others it is a part of facility operational cost control, their energy budget control, or it's about controlling a global energy use budget. These costs can drive facility relocations into countries or territories that allow the hourly control to achieve the associated end objectives. Regardless of the focus of the cost control consideration, controlling cost is a primary driver of participation. Yet, cost savings are not the end objective for any of the participants. For these participants the end objective is what can be done with the cost savings and how it impacts their position in the market. Cost saving is tool for these participants. That tool allows something else to be accomplished. For these key account participants, it is less about the savings and more about achieving the accomplishments that the savings can provide that is central to their view of success. While this concept may appear rudimentary to some, its importance should not be underestimated. If the savings are achieved, but achieved at a level that does not support the reasons for the participation decision, then the future decisions will be seen as risky and enthusiasm for

future replications of the project will be diminished. From this perspective, the participation decision is a financial concept decision on which future actions will be influenced.

Participants are focused on their bottom line and on how revenue can be increased, how profits can be strengthened, and how costs can be controlled. These participants value efficient and cost effective operations and they place a high value on reducing operational costs.

While it is important to understand the cost and investment decisions that play a role in the participation decisions, it is also important to understand the market environment that generates these cost and revenue concerns. All participants report that they operate within a competitive market and that this competition acts to hold costs and prices in check. Participants report that their competitors are looking for ways to extend a lower cost service to their customers. These participants report that predictability in their cost structure is important for maintaining their competitive position. Participants report that the program helps them keep energy costs in check, allowing more control and predictability in their energy cost structures. Participants report that operational budgets and pricing have to be both synchronized and dependable within their income and expense platforms. More predictability translates to more competitive pricing because they do not have to plan for energy cost risks that act to place upward pressure on pricing. Participants report that they need strategies to help them keep costs predictable with as low of a cost-risk as possible. Participants are interested in ways that allow them to remove or reduce uncertainty within their budgeting process, which serves as the foundation for their service offerings and operational success. They view the Smart Building Advantage Program as a way to help them keep costs predicable and acquire the advantages in the market that come with cost predictability.

Packaging the Program as a Complete Service

Participants report that the Smart Building Advantage Program is more than an energy efficiency program, more than a demand response program, and more than a control systems program. It is a program that brings the entire energy efficiency platform under one roof, with one set of participation hoops. Participants can go to a single program for a wide range of equipment, controls, and information management support. While both energy efficiency and demand response programs are available in other states and within Duke Energy's territory, this program brings it all together in a way that works cooperatively with the customer. "*It lets us bring our people to the table, with Duke Energy bringing their people, with both sides of the fence having the same goal.*"

One of the key values in the value proposition for participants is that this program brings together a set of conditions and services that are of value to customers. Managers report that, "*rebate programs are great, but anyone can do rebates.*" What these participants value about this program is that it brings the services they need together in a single place with a solid implementation and operational support framework. The words that were used to express this benefit were words and phrases such as:

- *"Brought in top notch talent"*
- *"Contributed money"*
- *"Helped us get it done"*
- *"Pulls it all together"*
- *"Takes the full load off of us"*
- *"Brings so many things together"*
- *"Looks forward"*
- *"Builds trust"*, etc.

Managers reported that it is the whole package of services, linked to funding, tied to professional talent, technical support, and hand-holding that made their experience worthwhile. *"This started at an expert level and built a track record along the way."*

Interviewees like the way the program operates as a coordinated team with their own managers. The program is viewed as not just another customer-vendor transaction, but as a structured teaming approach for solving a problem or taking advantage of an opportunity. The partnership with their internal team managers, third-party experts, and Duke Energy managers is an important part of the value proposition for these customers. Participants see the program as an engagement with an expert team with ongoing support and interaction. *"One of the strengths and the best parts of this is the interaction with the Duke technical team; this needed to happen."* Participants report that Duke Energy has worked with them in an understanding way that is considerate of the decision-making approach that they must use as well as the contracting approach required within multiple layers of internal management and decision-quality case building. *"This was a real partnership. The team approach is good."*

Managers reported that one of the key considerations for their participation was the promise of a longer-term partnership with Duke Energy and the commitment to the success of the project by the Duke Energy team. They reported that Duke Energy will not go away after the installs but will be with them to make sure the project works well. *"We like being the test site and partnering with Duke."* They like that Duke Energy's commitment goes beyond the project participation decision and will provide the help they need, should they need it. They like the personal commitment from Duke Energy's management and engineering teams. They consider the project a true partnership with risks and rewards important to the entire team.

This program builds trust. All participants indicated that they value their relationship with Duke Energy and consider Duke Energy one of their key business partners. The Smart Building Advantage Program allows participants to team with one of their trusted business allies to explore ways to take advantage of energy pricing and supply opportunities. Participants value being able to rely on the energy expertise of Duke Energy and their program contractors. This is the first teaming arrangement of this type with these participants – regardless of who provides their energy across their various locations. Participants report that this program is building and strengthening their relationship with Duke Energy. However, all participants took a wait-and-see attitude, and reserve their final assessment until they can see proof of results. The success of this

program, as expressed through post-participation corporate networking and experience sharing, will depend on delivered results. The success or lack of success from these projects will impact their relationships with Duke Energy.

Participants also expressed appreciation for one of the key components of the value proposition, which was not used in some cases but nevertheless was a valued item. Managers report that the offers from the Duke Energy team to present the projects to senior management were appreciated and were considered a valued part of their decision making process. Managers reported that primary core service needs take precedent over building energy system needs even when the return gained from the building system improvements are greater than the return expected from their core-mission projects. This means that sales presentations to upper management are important. The availability of the Duke Energy team to help present the case to senior managers, who are not as focused on buildings systems, was of value. *"We were comfortable with Duke's offer to go to our meetings and explain the details of this project to our chain of command." "We operate within a competitive internal decision making process. Infrastructure projects have to compete with core service needs. For these decisions, we are in a month-by-month, week-by-week competitive process."*

Transparency within the packaging and presentation of the program is important for trust building. Participants liked the fact that everyone is looking at the same information at the same time, with no hidden agendas that are typical with vendors who want to sell only their services and their equipment. This helped participants build their participation case and supported their decision to participate. Participants had the same information that the Duke Energy managers had at the same time. Duke Energy did not act as an information filter. None of the recommendations were prioritized or sanitized by Duke Energy or run through a preferred vendor filter before they were provided to the participants. The transparency of the process was a valued part of the process for these customers. They felt that they were getting the full story and the complete analysis. This helped build trust in the process, the analysis, and the recommendations. *"The transparency was helpful; we all saw the same information in the same draft documents."*

Participants like the fact that the program is not so highly defined that technology or management options are limited to a set of pre-qualified measures. They like the way the program can be tailored to their needs, their buildings, their systems, and their approach for management and decision making. *"The program is not so tightly defined that our options are limited. The program allows us to toss a broad blanket. We are not just fixing a piece of this, but are fixing the system. It allows us to think in broader terms."* Managers also report that the program is focusing on the right things. They like the flexibility to reduce both kW and kWh and they like the fact that the technical assessment can look for kW or kWh savings across any of the building systems. *"This approach fits with where we are, we have to lower consumption. We are not being steered into a direction we do not want to go."* Managers report that *"HVAC and lighting are building operations costs one and two for us, so these are important."* but they like programs that allow them to go beyond these areas.

Understanding Smart Grid

All participants reported a need to obtain Smart Grid experience and expertise. These participants see real time meters and pricing with price signals from their energy supplier becoming the standard practice within the non-residential market. They see their energy suppliers, such as Duke Energy, making these moves. Participants do not want to be caught unprepared. *"We see this program as a bridge to Smart Grid."* They want to be ready to take advantage of real time pricing opportunities, and more importantly, minimize the risks of these changes on their cost of operation. They want to maintain their market focus on being energy smart, using energy to service their customers' needs, while maintaining a low operational budget at the building and corporate levels. These participants see Smart Grid as a potential solutions platform. They see this program as a bridge to the Smart Grid's operational system. *"We need to get closer to Smart Grid solutions."* For these customers, participation is seen as a test of the monitoring and communications systems and its ability to react to price messages. These advanced supply and pricing approaches need to be understood well so that these participants can use them effectively. However, managers noted that these systems and their operational impacts need to invisible to their customers. Smart Grid systems cannot result in customer complaints or loss of customers within a competitive market.

Smart Grid and time-of-use pricing are growing concerns with possible opportunities for participants. They understand that demand and time-of-use issues will grow in importance and that they have to become experts with time-of-use control strategies and approaches for managing operations to be able to take advantage of Smart Grid. They do not want Smart Grid to control them or negatively influence their operations, performance, comfort, or costs. They want to be able to control energy to be able to take advantage of Smart Grid's capabilities.

These participants view this program as an "Introduction to Smart Grid". The program allows participants to gain experience with technologies and control strategies that they would not have tested on their own due to their corporate cost and risk requirements. *"This allowed us to test some things that we would not have tested on our own."* One of the values that interviewees expressed was that the Smart Building Advantage Program is providing participants with experience that is guided by a team of experts brought to the table by Duke Energy. The word *"test"* was used several times by multiple interviewees across various levels of management interviews. These participants are viewing this program and this participation event as a test case for guiding what they will do in the future.

All of the participants are apprehensive about over-investing in energy efficiency. Managers noted that they will be held accountable for results. While they view Smart Grid and real time pricing with mixed feelings, they see that they need to become experts in responding to price signals and demand costs. Participants report having had *"bad experiences"* dealing with Energy Service Companies (ESCOs). They understand that what is promised is not what is necessarily delivered and they know that a move to Smart Grid will complicate the picture. They also understand energy supply markets are changing fast and that they need to speed up their level of preparedness. They do not

want to be caught unprepared. This program, and this project, helps them "test the waters" a step at a time.

Participants are looking for proof that Smart Grid equipment and control strategies do what they promise. Participants report that they are looking forward to using more integrated technologies and building control systems that communicate with pricing information to achieve the anticipated benefits. These types of project are new for these customers. While they have experience in energy efficiency and with energy efficiency programs and incentive mechanisms, they want to be sure that Smart Grid-type systems deliver. Teaming with Duke Energy allows for a shared cost/shared risk approach in a single package. The assessment and recommendations of Duke Energy's experts, with the support of the participant's key engineering staff or contracted advisors, and the confirmation of the assessment approach and accuracy, helps reduce the investment uncertainty and helped to move these projects forward. These systems carry with them a degree of risk and participants not only need the savings to be there, but also value the Duke Energy team's ability to share the risk with the program's investment. *"The fact that Duke Energy is placing substantial resources into the pot means that Duke Energy is also sure that the savings will be achieved."*

Several of the participants suggested that Smart Grid will help them to continue to be the right-priced high-quality provider in their industry. They feel this program, this project, and the experience that they are gaining will help them be ready to use Smart Grid to further this mission. "*We want to continue to be the low-cost, high-quality provider in our industry and Smart Grid may help us.*" Participants see this project as getting their feet wet, and beginning the process to more aggressively control costs rather than increasing the cost of service. They see a future in which income will be squeezed and where cost-reduction will become a stronger focus for the industry. They see that they will have to become more skilled at acquiring cost reductions from their building systems. *"We need to be the best-in-class, high-quality service provider. I want us to be the benchmark for what this means in our industry."*

Getting the Right People with the Right Focus

The use of a nationally recognized building systems expert (Building Intelligence) was a critical part of the value proposition for these customers. It allowed participants to place trust in the analysis and recommendations, even when some of their own engineers were questioning the project's recommendations. The fact that the analysis and recommendations were conducted by an expert who has impeccable credentials and substantial experience is a critical element of the participation decision, but also for decisions to implement the recommendations. The third party engineer was very important for building the trust needed to support a decision to go forward. *"It is one thing to receive a vendor's recommendations, it is another to have a well known expert provide independent recommendations backed up with documentation. He has a positive reputation."* Managers also commended the recommendations provided by the third party expert. *"Our people said Duke Energy nailed it. We looked at the report and were impressed." "The real value in this was the engineering analysis. The incentive was critical for approval, but the engineering was very important."*

All of the interviewed participants report that having experts like Paul (Building Intelligence) and his team, who can bring this program to customers for Duke Energy is very important. Other people, who are less skilled and less qualified to conduct the analysis and make the recommendations, will not be as well received. *"The fundamental part of this is WHO has done the analysis. Everything is based on the credibility of that individual and that team. When the credibility is established, then we can look for opportunities. The incentive and the quality of the team together are key. "These guys are very knowledgeable; Paul is one of the best I have seen. He looks at all avenues and approaches."* Participants also like the fact that this team is knowledgeable about their building's equipment, their building control systems and their software. Participants did not want to go through a process of educating a Duke Energy program team. *"It is important that they have the right people doing this, bringing the people to the table who know what they are doing is important."*

Having the right people is important, but just as important is having those people provide the information needed to build trust and make an informed decision. Participants report that the level of detail provided from the assessment was beneficial. Participants felt that they were not obtaining a high-level summary analysis (as some had in the past through other audits) but received the details from the technical and financial analysis. The detail enabled the customer's engineers and financial managers to review and confirm the analysis. It was transparent. This process allowed participants to support the analysis and the resulting recommendations because they were able to confirm that the technical and financial analysis were in agreement. *"There was enough detail. We were able to use them for our approval. The Duke formats were good for our financial analysis. The numbers had credibility, we could use them right then."* According to the interviewed managers, Duke Energy provided the information in a way that worked well for the participants. *"They put it in terms we could use within our department. We were good with the way it was presented."* However, it should be understood that these participants had skilled engineering and financial managers on staff or available via support contracts. As future program plans are formed, it may be necessary to plan for participants who do not have the skilled engineering and financial expertise.

Moves Customers in a Direction They Want To Go

These large key account customers plan ahead. They do not wait for markets and conditions to influence them before they become engaged. They see that they need to move to a building management strategy that is more integrated - merging equipment selection, equipment type and equipment use and use conditions within an automated process that lowers cost and increases efficiency of operations. They understand that more advanced system automation is one of several routes for achieving this objective. Participants envision a future in which centralized, corporate-level control of building operations will improve maintenance and operational responsiveness while saving money. They see this move as a streamlining function of their operations and maintenance efforts associated with building and equipment performance. For some of the participants, the planning is at a global scale. These participants look at energy management and cost control as a global opportunity or management strategy. One in

which energy costs in one part of the world will need to be stabilized by actions in another part of the world. For others, the opportunities are at a national or regional scale with control strategies tailored for a few energy providers and the markets within these territories. For others, the opportunities are within their local facilities, in which energy opportunities will be focused within those structures. The over-arching moderators for this effort are upfront costs, comparative savings, internal expertise development, impact on operations, and customer satisfaction. This program takes them down the path that they already know that they want to go when conditions are ripe.

Participants realize that they need to build a more coordinated corporate-level approach to how they specify and select building technologies. These technologies will need to be more integrated in the future, and use standardized communication and control systems across their companies. They realize that their building-specific equipment selection practices of the past have harmed their ability to develop corporate-wide control systems and strategies that are compatible with Smart Grid and future hourly supply decisions. Several participants indicated that their past equipment and control choices have now trapped them into equipment that is not the best choice for their future. Participants report that they have different brands of equipment, controls, and communication systems that do not work as an integrated system. Some key equipment is incapable of communicating within their own facility communications systems. They understand that equipment and control choices go beyond thinking in single equipment terms or in bringing a downed building back up and in service. Participants view this program and these projects as a method for helping understand how to specify equipment in the future. If this effort proves successful (i.e. delivers an acceptable payback, improves operations and maintenance time and costs, is transparent, and does not decrease customer satisfaction), then the experience will result in modified equipment specifications and acquisition approaches for other buildings. This project essentially becomes an experimental equipment specifications development exercise.

Key managers indicated that their equipment and energy market price communication and control systems are not up set up or performing at the level of where they would like them to perform. They indicated that they need to improve their equipment and energy supply cost communications and response protocols and approaches. This program provides that help, not just in theory or in theoretical applications, but in real-life equipment that is designed to take advantage of price and supply signals and control approaches. It gives customers a start down a path they already want to go. *"Our energy communications systems are not adequate for us. This program allows our facility to begin the two-way communications with the utilities. It has to be two-way and we have to be able to take advantage of changes in price and opportunities. I like this."*

Participants report a need to increase automation when it can result in reduced labor hours and/or costs. Participants are interested in placing more equipment within an automated monitoring approach for operations and maintenance with the appropriate monitoring-based reporting. They report that this program and its associated monitoring strategies fit well with their automation objectives. *"We need the building to come to the technician, and not the other way around."*

Uses the Right Equipment and Technology

All participants indicated that the program has benefits in helping move to the right set of equipment and control strategies and provided a number of comments that focused on equipment and technology selection and operational conditions.

Participants realize that the Smart Grid is coming and that energy may be more expensive and more demand-priced. Some of the managers interviewed envision a world in which carbon will play a more important role in power supply decisions, both internally within their companies, but also externally as the market reacts to environmental issues. Several of these participants have made decisions to operate their buildings more efficiently and to move to technology systems that capture cost reduction and environmental benefits. The program's focus matches future technology needs and their move toward smarter energy management technologies.

Participants like the way the program is designed to integrate with what they have, rather than suggesting they convert to new systems, equipment, and approaches. Participants report that they like the way that technologies, system communications, and technology control strategies of the Smart Building Advantage Program can be integrated into their control strategies and equipment. One participant indicated that this is important for them globally as well. That is, the approach must fit within their strategies for energy use and control systems globally. Participants noted the need for a corporate-wide approach for energy equipment and management approaches, with consistency across buildings, states, and countries. The program's technical approach must fit the customers' equipment and configuration position in this evolving market condition. The program's objectives for how technologies should be integrated and controlled must match those of the participants.

Participants report that they need the real-time feedback and that they need the information to demonstrate to corporate management that these systems and technologies work. This trust is required before a move to standardized equipment and control approaches will gain full support. They need to demonstrate success with the approach. "*We need the feedback; we have to show our leadership the savings and results. This is as important as the project itself. If we can get the feedback, and demonstrate the savings, we can replicate this project and these control strategies and technologies in our buildings.*" This project will help participants get there if it performs well and they can demonstrate performance to their management.

Some interviewees reported that their standard approach for solving energy equipment problems is to repair the equipment and keep it in service, even in cases where upgrading would lower total cost. They report that their process focuses on repair as the first option of choice, followed by component replacement, rather than developing an integrated building-level solution. Internal competition for capital is one of the primary drivers for this policy. The Duke Energy program has allowed these managers to focus more on a systems integration approach when possible and profitable by demonstrating that it is better to address system-level needs rather than only focus on individual equipment

operation. *"We had a component replacement or repair approach and this project demonstrated a 'fix it right' approach; we went from a tree view to a forest view."* In this case the engineering team was ready for the move to an integrated approach before the senior financial management team was convinced of the desirability of this move. In this case the program was able to provide some confirmation of an equipment and control direction that had been suggested by the engineering team. The program helped them confirm to senior management that they were on the right equipment and control approach path.

In the past these participants have had private engineering teams come in and audit or assess their equipment and operations. Some report that they have been disappointed with the results. Managers reported that these teams have focused on selling only what they carry, pushing only their equipment and their control systems. They did not focus on what equipment and control and monitoring approaches would work best for the participants. These interviewees noted that other private audit teams have created as many problems as they have solved because of their narrow focus. *"We have had a lot of projects. Some did not work, some created more issues, and sometimes their engineering drove our operations* [instead of the other way around]." Participants reported that the Duke Energy team came in with a different attitude, a different focus, and different priorities. *"In this project they focused on our needs, our operations, and made the engineering fit our systems. They kept our people happy with the energy results* [operationally], *and we save money."*

One strategy common to these participants is the need to reduce costs through more advanced technologies and control systems and building better buildings. They see the move to energy savings via technology and communication systems integration as the right approach that balances the cost control and financial health motives with other corporate responsibilities.

Brings Money to the Table

The ability of the program to provide an incentive was a critical factor in all participants' decisions to participate in the program. The Duke Energy program incentive and the financial support for the analysis was a critical factor for participants. Participants liked that the financial risk was shared. *"They had a stake in the game."* The decision to go forward was strongly influenced by the program incentive, especially for the phase one analysis and recommendations. Some participants were able to acquire additional incentives, including one participant who was able to acquire an ARRA incentive from the state. *"Our phase one decision was made because of the Duke incentive. It brought the project in below our cost threshold, a critical level in our decision process. We have a different* [more restrictive] *approval process* [than other corporations].

Without the incentive the program cannot get to first base with these customers. At this time in the Smart Grid market development cycle, these customers are hesitant to launch these types of initiatives without utility incentives or other risk sharing support. Participants report that they would continue to do lower-cost, less comprehensive projects without financial help to offset risks and move the return on the investment to fit within

corporate needs. The incentive is key to the participation and implementation decisions of these customers.

Participants report that the economy is down and capital is tight. These two conditions mean that customers must be even more financially prudent when compared to periods when the economy is stronger. Participants report that they need to stretch each dollar and obtain more productivity per dollar while reducing recoverable costs. These participants report that the Smart Building Advantage Program is helping them achieve more of their energy expense related goals while saving money via the program's incentive system. *"Duke's financing is important. We would not be doing this without the program's financial help."*

All participants indicated that the Duke Energy program incentive allows them to obtain higher cost but more efficient equipment and control systems at a lower price. For all participants, the program is considered a cost-saving project. Several participants reported that the upfront costs without the program incentive were beyond their current reach and spend policies.

Supports the Customer's Environmental Objectives

These participants do not see profits and environmental responsibility as separate or incompatible concepts. Rather they see environmental stewardship as a part of the way in which profits are enhanced or costs are controlled or reduced. Several of the interviewees noted that having a strong environmental focus is central to their corporate mission and has a direct impact on their ability to competitively function in the market.

All participants report that they are concerned about their environmental image and want to move in a "green" direction. However, the level of concern is not consistent across the participants. While all participants indicated a need to continue to move in a green direction, some are more focused on this objective. One of these participants has a mission to be the best environmentally performing company in their line of business. Others want to make sure they are focused on environmental performance to the extent that is appropriate, but still indicated that having a green image is important. Even the participants that do not have a formal environmental mission operate as if they did. Most participants indicated that they want to be a leader in minimizing their carbon and environmental footprint. This program helps achieve that objective and saves money at the same time. Managers report that *"for each kWh saved we can reduce the need for one pound of fossil fuels." We want to give back to* [our] *clients, the environment, and to the community. This is our corporate view."* Participants want to be seen as being green, and they are not sure if they are green enough. *"We are not sure that we are green enough. Are we also helping Duke reach their energy and environmental goals? We need to be doing the right thing."*

Several participants indicated that they have an organizational commitment for achieving environmentally friendly facilities. Participants report that environmental performance is critically important for being able to attract more environmentally aware clients and customers. Organizations that do not show an environmental focus linked to matching performance will have a harder time attracting clients and customers. Incentives and

energy services, like those provided in this program, help move these participants toward being able to show/market/take credit for more environmentally friendly buildings. The "ouch" factor (as one interviewee put it) is the building that is close to being where we want it, but not yet there in the eyes of their clients and customers.

Educates the Customer's Employees

The educational aspects of the program are as important as the energy and cost savings for some participants, and for others more important. According to interviewees, the program is a good start on their Smart Grid educational objectives. However, several participants report that they would have preferred additional time and exposure with the program's technical assessment team. These participants want to learn the assessment and energy management skills and become more informed energy experts for their organization. These participants value the transfer of energy management information to their staff as a key reason for their decision to participate. Exposure to the program's technical team, the consulting engineers, and the ability to learn from them is important. For customers wanting to participate in order to build internal expertise, exposure to and working with the technical team is a primary benefit of their participation decision. *"This program provides ideas on what to do and how to do it. It lets us know what we should be doing."*

All of the interviewed participants view this project as an educational opportunity. Most managers reported learning from the process. Engineering staff learned new methods, systems, controls, and processes. *"We had already considered many of these types of things, but they took it to a whole new level."* Oversight and coordination staff learned about potential and how to gain opportunities. *"The team was excellent. They showed us what could be done."* Financing staff learned what could be achieved from a buildings systems project compared to other investments. *"Have you seen the return on this project? 58% return on the investment at 12% interest?"* Customers place high value in the program's ability to educate participants about what is possible as well as what works within a Smart Grid approach.

Participants report that they want to do the types of things recommended by the program but do not have the staff or all of the skills to do this internally. Time and staff are limited, and this program expands the capability of the participant's O&M teams by providing skilled people to assist in helping participants accomplish their environmental and energy goals. *"Duke's external high quality program team is good support for us. It adds resources that we do not have ourselves. We have good ideas, but may not have the time or resources to act on them. This also brings an outside source that brings credibility to the table."*

Provides a Competitive Market Advantage

According to participants, one of the most important driving factors in why customers values this program is "*market advantage*". Participants want to be seen and perform as the best business within their competitive environments. Customers see this program as a way to help them stay competitive. *"If we can save a dollar on energy costs that does not need to be passed on* [to our customers], *then we are a dollar more competitive in the market."* Participants view their program-induced savings as a future cost hedge strategy

that can be used strategically under a set of choice conditions (price vs. need). These managers see a future of higher energy costs that requires a systems approach to make cost-based choices. These managers also forecast increased costs as a result of Smart Grid unless they are actively able to control demand and consumption. That is, the businesses that are able to respond will acquire the savings, with the cost being passed on to those who cannot respond. Businesses that best capture cost control opportunities will have a competitive advantage in the market over those who do not. Being the first to reliably and cost effectively acquire these advantages is seen as strategic market hedge strategy against rising costs and tighter margins for their firms.

Reduces Downtime, Service Issues, and Complaints

All managers report that they like this project because it is not expected to slow, harm, or negatively impact operations. Managers report that it is important for the technologies and control system to not impact building use or operations. Changes have to be invisible to the users and not negatively impact how these facilities are used. Energy use is a way to provide a better operational environment for the functions being accomplished within these buildings. Energy systems are supportive to the operations which have to come first. "*Clients and users should not know the difference – it should not impact clients and use.*"

Controlling maintenance costs and equipment downtime are important for these participants. One of the reasons for participation for a number of the participants was to be able to reduce the operations and maintenance efforts for their staff engineers, and reduce the amount of equipment or facility down time. Each participant represented a different market. These include an advanced educational institution, a large national medical services organization, a large national commercial real-estate firm, and a global electronic and communications corporation. Being able to reduce or better control building-related service interruptions is important for each of the participants. Participants have to be able to use their facilities when and how they are needed and downtime that impacts operations has to be avoided. These participants report that they will have better control over their O&M function and should be able to reduce the amount of interruptions caused by equipment performance issues.

Why Customers Participated in the Smart Building Advantage Program

The individuals most responsible for making the participation decision were asked why they made the decision to participate in the Smart Building Advantage Program. Participants were given a series of reasons and asked to score the importance of each of the reasons in their decision or indicate if it was not a decision. They were also asked about "other" reasons that were not on the interview instrument. The table below provides the responses to these questions. The scores associated with each reason are provided, including the average score, the lowest score, the highest score, and the total number of individuals who indicated that this item was a reason for their participation. In addition we have calculated an overall score for the priority of the reason across all respondents. The priority score is the average score multiplied by the number of participants scoring that reason. Lastly, we grouped the reasons into priority categories to indicate if that reason is a very important reason, important, somewhat important or less important. These category groupings are subjective, and individuals may agree or disagree with the priority label provided.

Key managers report that there were four reasons that we have classified as very important reasons for participation. These reasons focus on financial returns, educational reasons, and risk reduction reasons. It is interesting to note that while financial returns are the most important reason using this scaling system, educational and risk reduction reasons rate in the top importance grouping as well. These findings quantitatively support the interview results suggesting that while financial reasons are important, educational objectives are also critically important and a primary driver for participation. In this "educational" response, the educational aspects focus on equipment selection to achieve the greatest energy savings. Likewise, the reasons associated with risk reduction also support this conclusion. That is, participants elected to participate because they do not think that they are experts in these types of decisions on their own, and need the program's support to reduce the risks associated with making a technology choice or application decision. Participation is seen as a risky decision, involving technology and technology control systems for which they need to build their level of expertise. As a result of these scores, we conclude that the program is structured to meet the most important objectives of the participants. However, the focus on educating the participants should not be underestimated in its importance. Participants are looking for an education and to build their expertise. This finding is supported by the things that participants report they would like to see improved that are presented later in this report, particularly the educational aspects of the interaction with the building assessment team.

Reason for Participating	Average Importance	Lowest Rating	Highest Rating	N	Priority Score	Priority Category
Maximize the return on the operational investments	8.8	8	10	6	53	Very important

Learn which equipment changes have greatest impact	8.5	5	10	6	51	Very important
Understand and or document achieved savings	8.3	5	10	6	50	Very important
Reduce operational or financial risks	7.1	3	10	7	50	Very important
Reduce energy costs	9	7	10	5	45	important
Gain experience with Smart Grid	8.8	7	10	5	44	important
Learn about best practices in energy management	8.6	8	10	5	43	important
Upgrade our equipment	8.2	7	9	5	41	important
Reduce equipment down time and maintenance time	6.8	1	10	6	41	important
Increase profits	9	8	10	4	36	Somewhat important
Improve satisfaction from facility users and customers	7.2	5	8	5	36	Somewhat important
Improve building use comfort	6.2	5	9	5	31	Somewhat important
Be able to understand behavior-related energy savings potential	7.5	4	10	4	30	Somewhat important
Improve worker or employee efficiency	7.3	6	8	4	29	Less important
Reduce staff or save on employee costs	5.8	3	8	5	29	Less important
Helps grow the business	9.3	8	10	3	28	Less important
Meet green, sustainability, or carbon reduction goals	9.3	8	10	3	28	Less important
Move to a single contact point or energy associated services	8.7	7	10	3	26	Less important
Focus more on our core business and less on energy management	7.7	7	9	3	23	Less important
Attract new tenants and customers	5.3	3	10	4	21	Important
Benchmark similar building types	8.5	8	9	2	17	Much Less Important

Reasons for participation that we labeled as "important reasons" focus on similar aspects of the very important reasons, but with somewhat different perspectives. Important reasons include reducing energy costs, a reason that is strongly related to the most important reason (return on the investment). Likewise, two other important reasons focus on the program's educational aspects, including gaining experience with Smart Grid and learning about best practice energy management approaches. Two other important reason include the ability to use the program to upgrade equipment, and to move toward approaches that reduce equipment downtime and time spent on equipment maintenance efforts. These findings support the focus on monetary benefits and education as critical

program deliverables, but expand into the areas of building operations, with a focus on equipment selection and operational and maintenance aspects.

Participation reasons that we labeled as somewhat important include the increase of profits, a reason strongly linked to the other financial reasons noted above. But equally important within this category is the desire to improve levels of satisfaction from facility users and customers. These were especially important for the university and real-estate participants but less important for the other participants. Comfort also entered the picture at this level of importance, with a need to improve or maintain user comfort levels. Also entering the participation reason at the somewhat important level is the need to understand behavior-related energy savings potential. This metric is not the savings potential from the equipment change-outs that are being made, but the savings that can be achieved via that equipment by modifying the behaviors associated with the people using the facilities.

Of less importance for the participation decision are aspects that deal with ancillary issues to those reported above. That is, the participants see these reasons as being connected with the project, but have less importance in their decision to participate. These include objectives related to employee productivity, reducing staff costs, growing the business, and meeting green-type objectives such as reducing carbon or having more sustainable buildings. Again, these are average scores. One participant, for example, indicated that their senior management wants their company to be seen as the most environmentally friendly firm in their line of business, while another firm has a very limited focus on being an environmental leader within their field. Of less importance to the pilot participants was a need to move to a single point of contact for their energy equipment and associated operations, being able to focus more of their time on their core business and less on building equipment and operations, or attracting more customers and tenants (although attracting tenants was important for one of the participants).

What Participants Like About the Program and Participants' Recommended Changes

The next two sections of this report provide information on what participants like about the program and what program design and operational changes they recommend. The information covered in these two sections of the report is presented in a way that may or may not reflect the priorities of both participant likes or their changes recommended in a quantitative way. This is because the responses were open-ended, allowing participants to identify both the topic and provide comments about that topic. Because of the small number of pilot participants, the presentation is structured to reflect the number of comments received for each of the key topic areas associated with their likes or their recommended changes. The topics covered first are those for which several participants identified it as a "like" or an issue that needs to be addressed for possible programmatic design or operational changes.

What Participants Like About the Program

Participants like this program. Participants identified a wide range of "likes" about the program. These are presented below.

The incentives capture the participant's attention
While the technical assessment is important for identifying what can be done, it is the incentives that move the decision forward. These participants have all experienced a building audit with recommendations to improve energy efficiency. However, without the financial incentive, low priority is placed on implementation. The technical assessment identifies what can be done, but the incentive closes the deal and moves the project forward. The incentive level drives participant interest and is the key factor in determining what can be or will be accomplished.

Experts promise savings
Participants like the way the savings are promised by national experts who understand buildings, building operations, and equipment performance. Promises of savings from private contractors or equipment suppliers have little impact compared to the promise of savings made by the program's experts who gain no benefit from sales of equipment or the level of savings achieved. They have credibility, and the savings estimates are trusted. Participants like the fact that they can believe the savings projected. This approach leads to belief in the promise of a financial return that meets the investment needs of the participants. Participants like the fact that they can have trust in the projections of cost, benefits, and financial returns.

Expands what they can do and allows they to do it sooner
Participants indicated that they like the way the program allows them to implement more improvements than they can do on their own and, at the same time, allows them to be completed sooner. Both the technical assessment and the Duke Energy incentives are the primary drivers of the expansion of actions taken and the accelerated timing of when they would, if ever, accomplish those upgrades on their own.

Participants like the fact that the program is flexible and does not focus on a single set of pre-approved actions, but can be innovative and focus on what makes sense for their buildings, equipment, operations, and financial resources. They also like the way the program can expand or contract its focus on what can be done to match the resources that participants can provide at a specific point in time. This flexibility is important because final decisions cannot be made until after the final technical designs and incentive amounts are fixed to a specific set of projected financial and operational benefits. The program allows them to understand costs, contributions, and benefits before they fully commit to what can be done. Participants like the flexibility and adoptability during the assessment period.

The educational benefits
All participants like the educational benefits of the program. They identified the SBA program as a program that moves into new territory and makes systems-based changes that are also focused on future supply and supply cost. This is an area of concern for these participants. They do not think that they are ready for all of the changes that will be associated with a move toward hourly supply decisions. Participants view this program as an important part of their learning about moving to an hourly supply and building

systems based approach to managing and acquiring energy supplies. Participants report that the program expands their vision of what is possible and gives them hands-on experience. It helps them understand what approaches they need to develop and what skills and knowledge they need to acquire. Participants view their participation as being equivalent to a Smart Grid preparation course, with real equipment, investments, savings, and benefits.

The way the program is focused on both kW and kWh
Participants like that the program covers energy efficiency as well as demand reduction approaches to increase savings. They like that the program is not focused on a set of pre-approved equipment or ways to reduce demand or consumption. They like that the analysis is free to explore any possible approaches to reducing energy costs. Participants are focused on cost reduction and the ways that they can achieve savings and do not want to be forced to only examine kW or kWh. They like the flexibility of the focus and they like the ability to focus on the customer's conditions and needs without restrictions limiting equipment choice or operational approach. Participants report that because it is flexible and focused on both kWh and kW, they can take advantage of the program as an integrated solutions-based program focused on the best technologies and approaches.

Quantitative nature of the program with objective feedback
The quantitative nature of the program is a key "like" of the participants. Participants want to know what is going on with their equipment and their use. They like the level of monitoring and the feedback information that is being incorporated into their projects. Performance tracking is important for these participants. They want real-time information to determine if their project is working and providing the benefits. They do not want to wait a week or even a few days to learn if they are doing the right things at the right time.

Duke Energy's responsiveness
Participants like the way Duke Energy has teamed with them as a project partner and has established communications and relationship approaches between the Duke Energy team and the participant's key leads. They like that the participation process has been customer-focused and that Duke Energy has supported their needs, timelines, and decision processes. Participants report that the participation process is smooth and is generally problem-free. However, they also provide a number of recommendations to improve the program. These are presented in the next section of this report.

The application process
Participants report that the application process was generally easy and that Duke Energy made that process as smooth as possible for a start-up pilot project that has a great deal of equipment and performance specificity. This application and contracting process was a multi-step process for these participants in which final participation was dependant on the contracting language and conditions. While participants provided recommendations for improving that process (see next section of this report) they are satisfied with that process and noted that the Duke Energy team worked with them in a way that was sensitive to the

customer's timelines and needs. They also report that program participation has been trouble free thus far.

Skilled knowledgeable professional team
Participants not only liked, but significantly value the expert technical team that Duke Energy brought to the program. All participants indicated that they liked the skills and the expert level of knowledge and experience of the technical experts on the program side. All participants reported that they enjoyed and valued working with the technical team. Participants considered this team one of the best if not the best in the country for helping to configure their projects and for estimating the savings. Participants reported that this team had a large impact on their decisions to move forward. Trust was established with the technical team, which led to contracted projects.

High quality assessment and management interaction support
Related to the quality of the technical team was the quality of the assessment and the way in which that assessment was brought to the participants. Participants reported that the Duke Energy team provided a very high quality technical assessment, but also worked with the participant's management to convey the information in way that senior management could understand. The technical assessment and the team interaction, working with senior management in a way that captured management's trust, convinced key decision makers that the savings would be real and will be obtained.

Ongoing communication
Participants also like the ability to have repeated and ongoing communications with the Duke Energy program team. Some participants reported that they needed to rely on the Duke Energy program team several times over the enrollment, contracting, and early participation processes, while others were able to work with the team as needed. In all cases, participants indicated that the liked having that communication and the ability to contact and be contacted by the Duke Energy team as needed. However, participants provided recommendations for improving the level and content of the communications efforts. These are presented in the next section of this report.

Changes Recommended by Participants

Participants also identified a number of things that they would like to see changed. These are presented below.

Improving the interaction between Duke Energy and the participant
All participants indicated that the interactions between the Duke Energy team and the participant could be improved, and all participants provided recommendations for changes. These recommendations are presented below.

Speed up the decision making process at Duke
The majority of the participants reported that there is a need to speed up the process for setting the incentive and communicating the incentive structure to the participant as soon as the technical recommendations are developed. Participants want clear and fast

information on what incentives they can expect with the recommendations made. Participants want to be able to assess the recommendations from the perspective of knowing how much it will cost and what the incentive will be.

Give bidders the project specifications early and allow time for bid preparation
A few participants recommended setting an RFP and bidding timeline that allows bidders to have full project specifications in time to provide a detailed bid based on a full understanding of the facility, the equipment, and the operational systems that need to be employed.

Work within each of the participant's corporate planning approaches
Most participants indicated that they must develop projects and move these projects through their corporate planning and approval process. These processes take from several months to several years to complete. Participants recommend that Duke Energy and the technical team spend some time learning about the participants' approval processes and timelines and then develop program processes, timelines, and procedures tailored to those processes. Most of the participants indicated that they had to fast-track the pilot projects in some way by moving outside of their normal project development and approval system. This condition is seen as one that lowers the chances of project approval because it sets the project up as an anomaly which attracts more attention from senior management. Participants would like to see the program become embedded within their investment decision approaches and become structured to operate over a one, two, three or more year planning process as needed by the individual participant. This means for some participants, the program team would need to begin planning for a project that would not be funded for a few years. However, these participants also know that the pilot program needed to get projects up and running fast in order to test the program concept.

Move to a multi-year, multi-project approach
Participants report that because their decision system often cover several years of planning, Duke Energy should structure the program so that there are multi-year projects and phased-in approaches within each participants' projects. Participants report that while they needed to plan for a single project for a specific implementation period, a full program should have the ability to team over a longer period of time, with project phases designed to match participant's budgeting and approval process. This type of process would match the project phase across multiple buildings and locations with a coordinated annual implementation process for not just one project, but for as many as the participants would like to plan for.

Make the incentive calculation process transparent
Participants reported that they wanted to know how the incentive calculation process works so that they can begin to estimate their own incentives based on the program's calculation rules and procedures. All participants reported the incentive calculation process was not explained well enough for them to understand how it works.

Smart Grid and Participation

Participants are not yet sure what the term "Smart Grid" means. But they know it means an energy supply system that is moving toward hourly-based pricing with greater ability for both the energy supplier and the energy consumer to have a greater real-time understanding of their energy use. Participants understand that the Smart Grid promises the ability to be able to take advantage of rapidly changing energy supply and price conditions. All participants reported that one of the key reasons for their participation was to help move their organizations to a monitoring environment in which they can make consumption decisions based on what is best for them or their customers. These participants view the Smart Building Advantage program as one of the key tools they have to help them move to a real-time price and supply decision framework that can be managed to meet their needs. They view program participation as both a defense and a strategic energy management issue. They want to be able to defend against rising prices or peak pricing conditions so that they are not financially harmed. At the same time, the want to be able to control their energy use relative to real-time pricing. *"This will help us reduce costs and supports our efforts to control costs within a Smart Grid approach."* However, they want that control in a way that when exercised, does not harm them or their customers. All customers reported that they are under higher pressure financial environments than they have been in the past, and have to be able to control energy costs. These participants do not view energy cost control as an option, but as a required part of their business operations. However, all participants indicated that they are not currently ready for Smart Grid and need time to develop their management strategies and bring their equipment and equipment control systems into compliance with their desired abilities. *"The timeframe* [to Smart Grid] *needs to be realistic."*

Participants also see Smart Grid as a motivational factor to move into new equipment monitoring approaches that will help them identify when a technology performance issue needs to be corrected. *"We will have real-time knowledge of what is going on. It's a red flag issue, we can use it to look at what is going wrong on-site and know what is causing energy use to go up* [and fix it]. *We can keep track of kW to see if we are on target or off. This should help us grab it right then, in real time."*

When managers were able to provide some specificity about what they expected from Smart Grid, they noted that Smart Grid was all about *"taking advantage of changes in market price to buy cheaper energy and reduce energy costs"* while still meeting user needs.

The following table provides their "importance" scores pertaining to their program participation and Smart Grid objectives.

Objectives Relating to Smart Grid	Average Importance	Lowest Rating	Highest Rating	N
Integrate HVAC system operations into control strategies	9.1	8	10	8
Integrate system control software and control sequencing and setpoints	8.8	8	10	8
Taking advantage of Smart Grid to manage non-HVAC	8.5	8	9	2

refrigeration				
Energy management, use tracking, and reporting	8.4	6	10	8
Alarms and action reports when use strategies are not working as specified or are outside of alarm trigger points, or when maintenance is due	8.4	7	10	8
Take advantage of hourly pricing to save energy and costs	8.3	7	9	8
Assessing opportunities to save energy via Smart Grid compatible equipment upgrades	7.7	7	8	7
Integrating Smart Grid and continuous commissioning analysis and system changes	7.6	4	10	8
Energy project design and specification assistance to assure Smart Grid capability	7.4	5	8	8
Integrating distributed generation into supply mix	7.3	2	10	6
Integrating Smart Grid and retro-commissioning analysis and system changes	7.3	4	9	8
Major capital equipment installation assistance to assure Smart Grid compatible operations	6.9	3	8	7
Benchmarking services to compare with other buildings like yours	6.8	4	9	8
Assessing where and when behavior changes can be most beneficial	6.6	3	9	7
Taking advantage of Smart Grid to manage lighting systems	6.1	3	10	8
Analysis of energy use per occupant or by square feet	5.8	2	10	8
Taking advantage of Smart Grid to manage water heating	5.6	2	9	8
Taking advantage of Smart Grid to manage non-HVAC pumps or motors	5.5	1	9	8
Taking advantage of Smart Grid to manage non-HVAC refrigeration	5.3	1	9	7

Program's Impact on the Way Equipment O&M is Performed

The individuals responsible for equipment operations and maintenance (O&M) practices within each participating firm was asked if the program has changed the way that they conducted their O&M activities. As noted in the responses presented in the following table, the results are not consistent across all the firms. However, the participants elected to answer this in two different ways. Two of the participants projected the changes that their participation would have on their O&M practices while the other two firms indicated that while they think that their participation will have an effect, they were not ready to project what that effect might be. The following table provides the responses to the way in which the O&M impact questions were answered by the four firms.

Program has changed the way the ally does...	Number Responding with:			
	Yes	No	Maybe	Too early to know
Controls Management				

Calibrate controls	2			2
Check control sequences	2			2
Maintain a written sequence of operations for the control systems	1	1		2
Conduct point by point control checks	1	1		2
Reprogram settings and sequences	1	1		2
Review performance changes when control changes are made	1	1		2
Maintenance Practices				
Perform routine examinations and performance reviews	2			2
Track key system component performance indicators	1	1		2
Clean or replace filters	1	1		2
Check performance tolerances on vents, dampers, or valves	1	1		2
Run test to check component operations and system performance	1		1	2
Track or log system maintenance efforts	0	2		2
Performance				
Calculate savings achieved in terms of energy or demand	2	0		2
Calculate dollars saved from control or maintenance practices	2	0		2
Obtain and respond to performance alarms	2	1		2
Speed of repair or problem solving	2	0		2
Benchmark performance against other facilities	1	1		2
Track and log maintenance costs	1			2

Best Approach for Accomplishing Specific Types of Objectives

Participants were asked which one of three different approaches is best for accomplishing different sets of objectives affiliated with the Smart Building Advantage program. These are also the same types of services that would be related to taking advantage of Smart Grid's potential to control costs. The three approach options were to: A) accomplish that objective themselves, B) hire a for-profit contractor for that objective, or C) team with Duke Energy to accomplish that objective via a program such as the Smart Building Advantage program. Nine different individuals were asked this question across the four interviewed participants. In some cases, the interviewees within the same firm provided different responses. Because the responses to these questions have competitive market value, all responses are presented in the following table, allowing the reader to understand the range of responses without identifying the participants providing those responses. The results from this table indicate significant diversity of opinions on how the participants would go about accomplishing their Smart Grid related objectives. However, it is clear from these responses that teaming with Duke Energy is viewed as one of the most important or the most important approach for these customers.

Which approach is preferred for reaching the following objectives?	Do it ourselves	Hire a for-profit contractor	Team with Duke

			Energy to do it
Take advantage of newest Smart Grid approaches to control costs	1	0	7
Best way to keep informed of benefits and risks of various control strategies and approaches	0	3	6
Brings the right skills, knowledge, and resources to the project	1	2	6
Offer for consideration only those strategies that are cost-effective	1	4	4
Identify all possible energy management strategies in customer's facilities	2	2	4
Make sure the full range of energy efficiency and management strategies are considered for decision	4	2	3
Best way to keep project on time and on budget	5	1	3
Uses service providers that the customer can trust	4	2	3
Install only the most reliable systems & equipment	2	3	3
Most accurately documents achieved savings via a control strategy	3	2	3
Offer equipment pricing packages that best meets the customer's needs	2	2	3
Best manage a project's costs and budgets	4	2	2
User service providers that put customer's needs first	5	1	2

Performance Feedback

All key managers indicated that they are satisfied with the performance feedback systems planned into the project and are confident that these systems will allow them to keep the system performing as planned and designed and achieving the projected energy savings. However, these managers also report that they are not going to abandon their current approaches until they are certain that the new approaches are accomplishing their objectives. These interviewees report that the program is bringing in new approaches for monitoring and keeping them informed on how their equipment is operating and how their building is performing relative to expectations and projections. However, these participants express some degree of caution, and are taking a "trust but confirm" approach. Most managers indicated that the ability of this program and these changes are key to their future efforts. They must see success in these efforts before they will place full trust in the program's projections. *"Let's see the numbers; we would not have looked at all of this. We are on the right track, but we will see."* Yet these participants are also optimistic and report that they are confident that the savings will be there if the equipment and control strategies that they are implementing work as expected. All participants like the way the program is working with them and their team members to make sure they obtain and can use the performance feedback provided.

Are Customers Interested in Behavior Change Opportunities?

All four of the pilot participants are interested in the opportunities to acquire additional energy savings by changing the behaviors of the people who use their buildings. However, all participants also indicated that changing behavior has to be done carefully and not alienate their users. All participants indicated that the functions performed within their buildings must not be impacted in a way that causes issues with those users. These

concerns were expressed regardless of the how the buildings are used or if they are used by employees, clients, or customers. Maintaining productivity and or user satisfaction is paramount to these participants and overrides any interest in behavior modification to capture additional energy savings. Still, if savings can be captured without negative impacts, these participants are interested in carefully considering these potentials.

Equipment Purchase Decision Criteria

Interviewees were asked about the criteria they use to make equipment purchase and replacement decisions and to rate the importance of that criteria. As noted in the following table, the energy costs to operate the equipment, the ability to obtain parts, the total life-cycle cost (cost to purchase, install, operate, and maintain), the internal rate of return from the savings, and the strength of their vendor relationship are the most important criteria for these four participants. Likewise, the next five most important criteria are similar to but supportive of the top rated criteria (past equipment performance, simple pay-back, maintenance cost, contractor availability, and expected life of the equipment). Next in importance is the equipment recommendation that they would receive from Duke Energy. The first cost of the equipment (cost to buy) for this group of participants is the 15th most important criteria, scoring well below other considerations. This data indicates that the program's participants consider all costs associated with an equipment purchase decision before they buy, and that the ability to maintain least total cost operations and acquire a return on their investment are most important. But also important is the ability to service and maintain that equipment through parts availability and access to service professionals when it is needed.

	Criteria	Average importance	Lowest Rating	Highest Rating	N
1	Energy costs to operate	8.2	7	10	5
2	Parts availability	8.2	6	10	5
3	Total life-cycle cost	7.8	7	10	5
4	Internal rate of return on investment	7.6	6	10	5
5	Strength of vendor relationship	7.6	4	10	5
6	Past performance of equipment	7.4	5	10	5
7	Simple pay-back analysis	7.3	6	8	4
8	Maintenance costs	7.0	6	8	5
9	Contractor or trade ally availability	7.0	6	8	5
10	Expected useful life of the equipment	7.0	5	9	5
11	Utility recommendation	6.8	5	8	4
12	First costs of the equipment	6.0	3	8	5
13	Familiarity with the brand	6.0	4	8	5
14	Brand name or brand trust	5.8	4	8	5
15	Contractor or trade ally recommendation	5.0	5	5	4

Energy Policies

Only one of the participants indicated that they have a formal corporation-wide energy policy that drives energy related decisions. However, all participants indicated that they have an informal policy or a corporate energy ethic that focuses on energy efficiency and environmental performance. For one of the participants, having an environmental and energy efficient focus is critical, as their clients demand environmental leadership and performance. This participant indicated that they have a formal policy and they must report progress on their energy and environmental objectives to their Board of Directors. The other participants indicated that energy efficiency and environmental performance is important to their organization. One firm indicated that while they do not have an energy policy, they want to be seen in the market as being the most energy efficient and environmental friendly firm in their line of business. The other two participants consider energy efficiency and environmental performance important and they projected that it will become more important in the future.

One of the participants indicated that not only is it important for them to be energy efficient and environmentally focused, but they have an objective to help make their energy suppliers more energy efficient and reduce the amount of greenhouse gas emissions associated with the energy that they buy. One participant indicated that they have formed a team in their organization to specifically focus on helping the organization be "greener" each year. Another firm indicated that they have a corporate objective to lower consumption by 25% by 2012 and report on their progress toward that objective.

All of the participants want to have energy efficient buildings, with two of the participants having specific LEED objectives for all new construction, while others want to move toward LEED-like or Energy Star performance without going through the costly LEED certification process.

Marketing of the Smart Building Advantage Program

Participants were asked to recommend program marketing approaches that the program should use to make Duke Energy's customers aware of the program in a way that will allow Duke Energy to capture greater numbers of participants. All participants provided recommendations. All participants recommended the use of case studies, stories in trade journals, partnering with organizations that focus on energy savings and environmental issues, and the expansion of the Duke Energy website. Three of the four participants recommended displays at trade shows, presentations at industry conferences, and working with industry groups and organizations. Two of the participants suggested that white papers focusing on the energy savings that are being achieved by these approaches should be used and working with consortiums of companies within specific segments that can most take advantage of the program. None of the participants suggested that social media tools should be used, and all interviewees indicated that they do not use social media for professional or work-related information. Most of the interviewees suggested that social media web-sites are "for younger people" and all question if these are appropriate for conveying program marketing materials, ideas, or concepts. The following table provides the responses of the interviewed participants. The results are presented for the four pilot

program participants such that a score of 4 means that it was recommended by at least one of the individuals interviewed from each firm.

Marketing Approach	Recommended	Not Recommended	Unsure
Case studies	4	-	-
Trade journals	4	-	-
Partner with other organizations	4	-	-
Expand the Duke Energy website	4	-	-
Trade shows	3	1	-
Industry conferences	3	-	-
Work with industry groups & organizations	3	1	-
White papers and publications	2	1	1
Consortiums of companies	2	1	1
Social media tools	-	2	2
Other methods	-	-	-

The interviewees provided qualifying comments about their recommendations. These comments are noted below for each of the marketing approaches covered in the interviews.

Case studies

- "These can be good if they are a "show me the data" study. You have to make them real studies with real companies, real projects, real data, and real savings. Get them to the engineers and the administrative decision makers."
- "These are good, get them out to the customers via the account reps."
- "These need to be objective (not sales pieces), truthful, and real. Then they can be effective."
- "This is a very good approach."

Trade journals

- "The medical services administrative and health care journals are good, and *Facility Manager* is a good one."
- "I would recommend *Facility Manager*."
- "*Facility Manager* is a good one."
- "*Energy Biz Today*, *Gas Daily*, and *Electric Daily* are good ones."

Partner with other organizations

- "The DOE and EPA have a lot of networks in the industry. They could be good partners."
- "USDOE, LEED, Energy Star, state and local energy agencies, tax credit organizations, stimulus package networks, and renewable energy organizations should be considered."

- "Get with organizations that can leverage other funds. For example, ARRA[1] and the Department of Energy."
- "Partner with the green organizations. The green energy and solar stuff reaches some of the right people."
- "The American College and University President's Climate Commitment Organization (ACUPCC) would be good."
- "Sustainability organizations might be good."
- "Endowment foundation organizations that are looking to be seen as environmentally active."

Expand the Duke Energy website

- "This is what we use now. The Duke site is a main link for us."
- "The Duke site "My Energy Portal" message center is good."
- "The Duke site and the internet is where people go for information now."
- "Put it on the Duke web site and have it linked to the energy bills pages with icons. Realize it has to be very good, very fast, and very easy. We are information overloaded with the stuff on the internet, but if it is good, easy, and focused it can work well."

Trade shows

- "Need to be very selective, not all are good. Not the engineering shows, but the administration and operations side for the health care industry, for example. And focus on the money not the technology. Focus on the investment benefits and the returns."
- "Shows like the EEI[2] would be good."
- "Focus on shows like NeoCon[3]."

Industry conferences

- "Get on the agenda of EPA, Energy Star, ASHRAE[4], and other similar conferences. Go to the administrative and management conferences that focus on costs and benefits."
- "Go to the Association of Physical Plant Administrators."
- "BOMA[5] and NAIOP[6] would be good ones."
- "You need to be very good at these things and have displays that capture attention or you will not be successful. But if you can grab attention, then IFMA[7], BOMA and IIDA[8] are good."

Work with industry groups & organizations

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[1] American Recovery and Reinvestment Act
[2] Edison Electric Institute
[3] MMPI's NeoCon Trade Shows
[4] The American Society of Heating, Refrigerating and Air-Conditioning Engineers
[5] Building Owners and Managers Association International
[6] Commercial Real Estate Development Association
[7] The International Facility Management Association
[8] International Interior Design Association

- "The North Carolina Health Care Engineers is an excellent group. There are other professional associations and trade groups that might be good."
- "Work with BOMA and NEMA[9]."

White papers and publications

- "These can be good if you reach the right people, but only a few of us read white papers."
- "This is okay for some. You have to reach the right people, and this is not a great approach for most of us."

Consortiums of companies

- "The health care people go to annual meetings. If you can get to these, that might help. Notation and Premier and buyer groups might also help."
- "These may help, but be careful of liability of working with teams of companies. Utility networking within your customers should be used."
- "Use Duke as a conduit to customers. We have developed a California Bay Area group called the Silicon Valley Leadership Group with 200 members and monthly meetings, projects, and technology reviews. It is a great information source that focuses on utility programs and other opportunities."

Social media tools

- "These may be okay for residential programs, but not commercial sector programs."
- "Not for my generation, maybe the younger generation, it is what they do now."
- "We do not use them, but younger people do."
- "There are some social media linkages that can work, but may not be a good approach. They may have some professional people out there using these things. As a company we have to go there, we cannot avoid it, but they may not be effective and have some real down-sides to them."

Other methods

- "Showcase this at the annual Duke Energy customer meetings."
- "Launch a top-down approach with the large key customers. Go to the top people (the owners, presidents, CEOs, CFOs, the senior people) and get them to focus on it, they will pass it down if it looks promising. When things come from the top, we pay attention to it."
- "Market this as a new way to find revenue in a company."
- "Bring in the high quality people. Get people like Paul involved and let them work with the customers to make the choices of what to do. Build trust in the industry via this program. Bring in the customer's management and administration, get them to the table. Help move decisions up the chain of command."

[9] National Electrical Manufacturers Association

Market Effects

The interviewed participants report that the SBA program is having a significant educational impact on their engineering and maintenance teams and how they plan future changes, but has not yet moved beyond the people directly involved. Most participants are not showcasing their participation to a large degree and do not plan to until savings are verified. However, all participants indicate that corporate management is taking note of the program and is interested in the results. The engineering teams and people responsible for the equipment and performance indicate that the program has expanded what they thought they could do and has caused them to think beyond the single piece of equipment and focus more on a building integration systems approach to controlling cost and meeting the demands of the buildings' users. Interviewees report that if the projects they are implementing prove successful, their companies will be interested in more projects like these and will be more supportive of allocating resources to them. However, at this time the effects of the program beyond the engineering and financial managers are limited.

Final Report

Evaluation of the Residential Smart $aver® Program in Ohio

Results of a Process Evaluation

Prepared for
Duke Energy

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Executive Summary

Summary of Findings

An overview of the key findings identified through this evaluation is presented in this section.

Significant Process Evaluation Findings

- The overall participant satisfaction with the program is very high at 9.4 on a one-to-ten scale.

- Surveyed program participants cited general advertising and increased incentive as the two most effective ways to increase participation in the Residential Smart $aver® program.

- The majority (60%) of surveyed participants indicated that they were replacing equipment that had failed or was very near the end of its effective useful life.

- The trade allies would like to have the Residential Smart $aver® program application process available using a Web browser. This would make the program operate more smoothly for both Duke Energy staff and the Smart $aver® partnering trade allies and would speed accessibility to the participation process and eliminate problems with obtaining or printing hard-copy application forms and transmitting them via fax or scanned email.

- The trade allies would like the incentives to be offered to all Duke Energy customers, specifically, they would like to see the inclusion of those customers who are currently ineligible because they receive natural gas service from Duke Energy but receive electricity from another utility. Alternatively, they would like an easier way to identify eligible customers.

- The trade allies would like an increase in collaborative marketing between Duke Energy and the trade allies to raise awareness of the program. To achieve this they suggested that Duke Energy provide more literature on the program directly to their customers, to the trade allies and to a list of targeted contacts supplied by trade allies.

- All trade allies considered the Smart $aver® program an essential sales tool for energy efficient equipment.

Recommendations

- **Early retirement marketing and incentives**: Consider providing incentives for early retirement of equipment that are below existing federal levels. This would enable Duke Energy to continue to improve the penetration of high efficiency HVAC equipment while the HVAC technology advances further beyond existing federal standards. The costs of

documenting and verifying early retirement measures are higher than just documenting purchases of higher efficiency equipment. However, because existing federal standards have recently increased, the program management acknowledges that the current Residential Smart $aver® incentives may not be enough to overcome the costs of obtaining higher-than-federal standard efficiencies.

- **Increased budget allocations**: Consider requesting higher levels of energy efficiency spending from the Commission to help meet program demand, thereby increasing energy savings without harming other programs in the portfolio.

- **Test new technologies:** Consider test piloting the addition of WECC recommended technologies starting with incentive levels that provide cost effective energy savings from those technologies. These include package heat pump units and mini-split ductless HVAC systems.

Introduction

This report presents the results of a process evaluation of the 2009 Residential Smart $aver® Program in Ohio. This effort employed interviews with program trade allies and a survey of residential customers using the program. To conduct the process evaluation we interviewed eight trade allies and surveyed fifty-five program participants.

Program Description

The Duke Energy Residential Smart $aver® program provides rebates for installations of higher efficiency heating and cooling measures in new or existing homes. Qualified purchases by residential customers are eligible for rebates of $200 to the homeowner, and $100 to the HVAC contractor/dealer. Home builders who install qualified equipment are eligible for rebates of $300 that they may choose to pass on to the home buyers.

There are three types of measures for which rebates are available: central air conditioners (AC), heating heat pumps, and electronically commutated motors (ECM)s. Duke Energy provides rebates for measures that have higher efficiency performance levels that are above current federal standards.

In Ohio, Duke Energy also offers a $300 rebate for 90% efficient gas furnaces.

To participate, Duke Energy customers work directly with a participating contractor, select the eligible equipment, and provide their Duke Energy account number. The contractor completes the application for the rebate, providing the necessary AHRI certificates. Duke then processes the rebates and sends incentives to the customer and/or the contactor.

The program has been highly successful, to the extent that halfway through the program year, the implementer (Wisconsin Energy Conservation Corp - WECC) was directed by Duke Energy to focus more attention on recruiting Non-Residential Smart $aver® trade allies in order to promote the non-residential program's services, and place less focus on the residential program. That is, program demand out-stripped the program budget's ability to meet customer demand for the program. The limits on the approved budget and the associated cost recovery mechanism acted to moderate the program enrollment efforts limiting participation and energy savings.

Process Evaluation Results

This section presents the findings from the process evaluation, which included in-depth interviews with program management, interviews with program implementers, and participant surveys.

Operational Efficiency & Implementation

Roles

Duke Energy manages vendors who implement the program. The main program vendor is the Wisconsin Energy Conservation Corporation (WECC) who covers the program within the five states in Duke Energy's territory: Ohio, North Carolina, South Carolina, Kentucky, and Indiana. Another vendor, Customer Link, handles customer phone calls and answers questions about general program information. The Duke Energy program manager reports that he is extremely satisfied with WECC's implementation of the Residential Smart $aver® program. *"They are a good handful to work with."* WECC began implementing the program in February of 2009 for Ohio.

WECC staff members serve as trade ally representatives and support the trade allies in all aspects. WECC trade ally reps inform prospective trade allies about the benefits of participating in the program, train trade allies on the application process, and answer trade ally questions about the status of the applications and rebates. WECC has a global goal of recruiting 30 trade allies a month across both the Residential and Non-Residential Smart $aver® Programs in the five states in Duke Energy's service territory.

Trade allies are participating HVAC contractors, distributors, and dealers who sell high efficiency equipment to Duke Energy's customers. The Duke Energy program manager acknowledges *"The trade allies are what makes this program work. We use this network in the home when the customer is making the decision."*

Trade allies are informed about the program through WECC trade ally representatives. Duke Energy and WECC have started conducting round table meetings with the trade allies in order to solicit their feedback on various aspects of the program. There were two trade ally round tables in the past program year.

Processing Applications and Rebates

Applications are processed by WECC within three days of receipt. If there are any errors in the application, the trade allies receive a letter within that three day period. If there are no errors, the rebate checks are sent out and the trade allies and customers receive them within 5 to 7 days of application. This response time is a best-practice in the industry. Few utility programs can match this performance, with typical approval and rebate processing taking 3 to 6 weeks.

For each qualifying measure, the customer receives $200 and the dealer receives $100. WECC reports they have received many compliments from the trade allies and customers on the speed with which they receive the rebate checks. Along with the checks, WECC also sends an acknowledgement letter that informs the customer that they may be visited by a Duke Energy representative in order to verify installation.

Marketing to Customers

The Duke Energy program manager reports that the program has been in operation for over 18 years and is running smoothly. The main method of marketing the program to residential customers is through the trade ally network. By all accounts, the trade allies are doing an excellent job of informing customers of the availability of the rebate from Duke Energy. The Duke Energy program manager reports that the trade allies are so effective that it is no longer necessary to market the program, although the program continues to be marketed on the Duke Energy website. This condition is consistent with a program that is well received by the contractors and trade allies, and has been in the market long enough to become established such that trade ally networks and customer networking has replaced the need for customer-focused market push efforts. The Duke Energy program manager also reports that the trade allies also have done an excellent job leveraging the federal tax credit to further motivate residential customers to purchase high efficiency measures.

Marketing to Trade Allies

The Residential Smart $aver® program has been so successful in recruiting trade allies over the years that very little ally marketing is needed. WECC reports, *"We rarely come across a dealer who is not aware of the program"*.

The WECC program manager reports that the program is so well known that residential customers will often ask for the rebate from non-participating dealers, in turn motivating the those dealers to contact Duke Energy and WECC to become participating trade allies. Another channel for prospective new trade allies comes from Customer Link, the call center that handles calls from Duke Energy customers. WECC reports that in many cases the customer will tell Customer Link that their dealer doesn't know about the Residential Smart $aver® program. Customer Link then passes that lead on to WECC for follow up contact and recruitment. As a result, the customer's contact with Duke Energy becomes the seed for growing the program's trade ally network and increasing both exposure and demand.

In the initial phases when Duke Energy and WECC were starting to promote the program, they used a top down approach by targeting the manufacturers, who then helped promote the program to their distributors and dealers. WECC reports *"Word got around very quickly"*. In this process the manufacturers saw the program as a way to move the higher end more efficient product lines and help increase revenues for their dealers; a win-win situation.

Training Trade Allies

At this stage, most dealers are aware of the program and the training of new trade allies has become a smaller and less important effort. When a new dealer becomes interesting in participating, WECC conducts training sessions with that dealer's sales team.

In the initial stages of the program, WECC has conducted training sessions with some of the larger distributors and contractor associations, but WECC reports that training sessions on that scale have not been needed for over six months.

Quality Control

WECC implements a quality control procedure in their review of the rebate applications. The review is incorporated into the rebate processing procedure. WECC maintains the database of program data including participant information, the specific measures rebated, and the rebate amounts. Duke Energy has full access to the database, and reports *"They have a very good database and good IT and are very responsive to all [Duke's] demands."* The Duke Energy program manager also compliments WECC's quality control processes: *"All their processes seem as transparent as possible, and* [transparency] *is the greatest Quality Control."*

The Residential Smart $aver® program also has an ongoing verification process; however, the program relies heavily on trade allies to provide accurate information about the installed equipment. WECC trade ally representatives inspect 5% of all installations, and sampling is stratified in three ways: 1. within qualifying equipment, 2. within the geographic boundaries of target cities, and 3. within high-activity trade allies. Trade allies who have unacceptable error rates in documentation or installation are flagged by WECC for higher inspection rates. Trade allies can be excluded from program participation if their verification rates are unacceptably low or if improvements are slow.

Although the Residential Smart $aver® program requires the HVAC system to include an ECM fan, currently only visual inspections are conducted. WECC mentions that there may be some potential for fraud if trade allies do not actually install an ECM fan; however, this potential is considered small.

Future Program Directions

Both Duke Energy and WECC foresee that program participation will drop once the federal tax credits for energy efficiency expire. It will be a challenge to maintain the high levels of participation without being able to leverage additional tax credits, particularly given the poor economy.

WECC suggests that the next best participants to target will be the home builders. WECC reports that the poor economy has been difficult for home builders, but that the upcoming Energy Star changes may renew builder interest in the Residential Smart $aver® program's rebates. WECC is hopeful that the new Energy Star standards that are due to be rolled out in 2011 will help make installations of high efficiency HVAC equipment a standard practice among builders.

WECC and Duke Energy program managers both mention that one of Duke Energy's future challenges would be to revise the Residential Smart $aver® program eligibility rules to stay ahead of the Energy Star standards. With Energy Star standards tightening to SEER 14, Duke Energy may choose to revise Residential Smart $aver® standards to SEER 14.5 or SEER 15.

Future Improvements

There are very few areas for program improvement. WECC feels that the program is running very smoothly and efficiently. *"It's like clockwork."* The only area that might bear improvement would be the application process. WECC suggests that some examples of filled out applications might be published online, to help dealers avoid common errors in the application process. WECC also reports that while a new dealer's first batch of applications might contain errors,

those dealers quickly learn what the applications require because WECC gives them feedback on how to improve their submissions.

Duke Energy reports that there are many ways in which the program might expand. The Duke Energy program manager reports that in his 18 years of experience in Duke Energy's Residential Smart $aver® program, the program has offered rebates on several different HVAC measures. One measure offered in the past was duct insulation, and another was duct sealing. Both of those are under consideration for future program offerings.

The Duke Energy program manager reports that that they are currently investigating the potential impact and cost effectiveness of several of these options, but that the analyses have not yet been completed. Once the cost effectiveness analysis is completed, Duke Energy will decide if these measures should be included.

The Duke Energy program manager also reports that there will be a new web feature launched in the fall of 2010 that will direct online bill payers to a survey. The survey will provide Duke Energy with information about the age of the customers' furnaces and AC equipment. This would potentially allow Duke Energy to target specific customers for early replacement.

New Technologies

Based upon customer interest conveyed by the trade allies, the WECC program manager suggests two types of technology to consider for future inclusion in the Residential Smart $aver®. The first is a package heat pump unit, which can be placed entirely outside the house. The difficulty in including this measure is that current federal standards require an HSTF of 8.0. Achieving this performance threshold requires rebating higher cost units that are in limited supply because of lack of market demand at their current price. Providing rebates that would bring the cost of the units down to an attractive price for customers would likely decrease the cost effectiveness of the program as a whole because it will lower the amount of savings achieved per dollar of program costs compared to the current measures. The second measure recommended is a mini-split ductless HVAC system. WECC acknowledges that while there is a lot of interest in mini-splits because of the benefits of not needing ducting, however WECC reports that it is difficult to design a rebate system given the varying tonnage and efficiencies of the current mini-splits. *"It's hard to equate mini-split [energy] impacts with a 3-ton conventional unit."*

Incentive Levels

The trade allies have suggested at a round table meeting that Duke Energy might offer tiered incentive levels. The federal efficiency standards have increased to the extent that the Residential Smart $aver® program is hard pressed to find enough equipment that is higher than federal efficiency that would interest the customers at a reasonable cost. Each movement in efficiency comes at a higher cost, especially as new standards push the efficiency threshold higher and higher. Incentive levels would need to be revised to reflect those increased costs and cost effectiveness objectives may need to be adjusted. This would require Commission approval.

Program Successes

WECC reports that participation has been highly successful, significantly beyond anticipated levels. The Duke Energy program manager is also satisfied with the program, and could not

name anything that needed immediate improvement. *"It all works well. It is a seasoned program."*

Participant Survey Results

In June 2010, TecMarket Works interviewed 55 out of a possible 9,929 Residential Smart $aver® participants during 2009 for which we were provided contact data and measure descriptions.

Housing Type and Equipment Used

Fifty-five surveyed participants' equipment purchases include:

- Forty-three 90 percent efficient gas furnaces,
- Nine 14 SEER heat pumps with ECM,
- Eight 14 SEER AC with ECM.

The equipment purchase total is sixty units because five of the participants purchased both an AC or HP and a gas furnace.

Fifty-three surveyed participants indicated that their house was built over a basement and one had a home built over a crawlspace. One participant was unsure. 24 participants indicated that the ductwork ran primarily through the basement, 29 said the ductwork ran primarily through the interior walls. One participant (whose house was built over a crawlspace) indicated that his ductwork ran primarily through the attic.

Overall Satisfaction

Participants were asked about their overall satisfaction on a one-to-ten scale with one indicating they were completely unsatisfied and ten indicating that they were completely satisfied with the Smart $aver® program as well as the satisfaction with information provided by the program, amount of rebate, ease of filling out the forms, time to receive their rebate check, and number of technologies covered by the program. As shown in Figure 1, Primary participants have a very high satisfaction rate of 9.4 overall with the Residential Smart $aver® Program. Only the rebate amount category received any ratings less than 7 with two customers giving it a five and two customers giving it a six. These four customers indicate that a higher rebate amount would increase their satisfaction level.

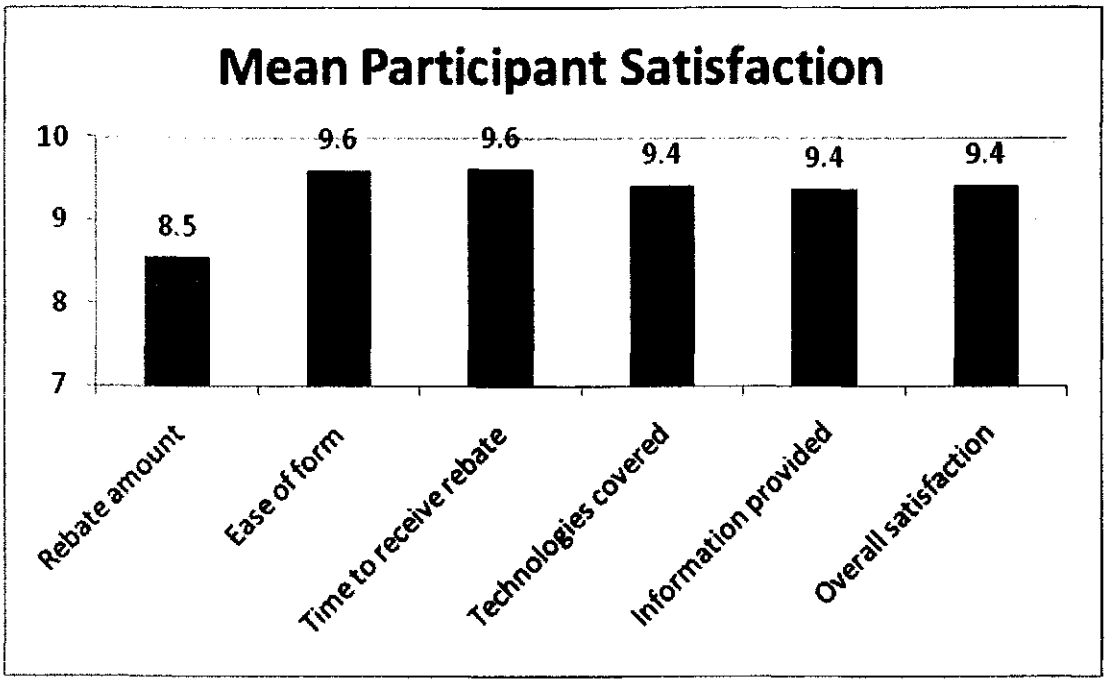

Figure 1. Mean Residential Smart $aver® Satisfaction Ratings (n=55)

Primary Motivating Factors

Participants were asked for the primary factor that motivated them to purchase their current equipment or replace the existing equipment. Nearly half of all respondents (47.3%) indicated that equipment failure was their primary reason for buying the new equipment Figure 2 shows the factors mentioned as well as the percentage of participants surveyed who mentioned that factor. Less than ten percent of respondents (five out of fifty-five) reported that energy saving was their primary motivating factor.

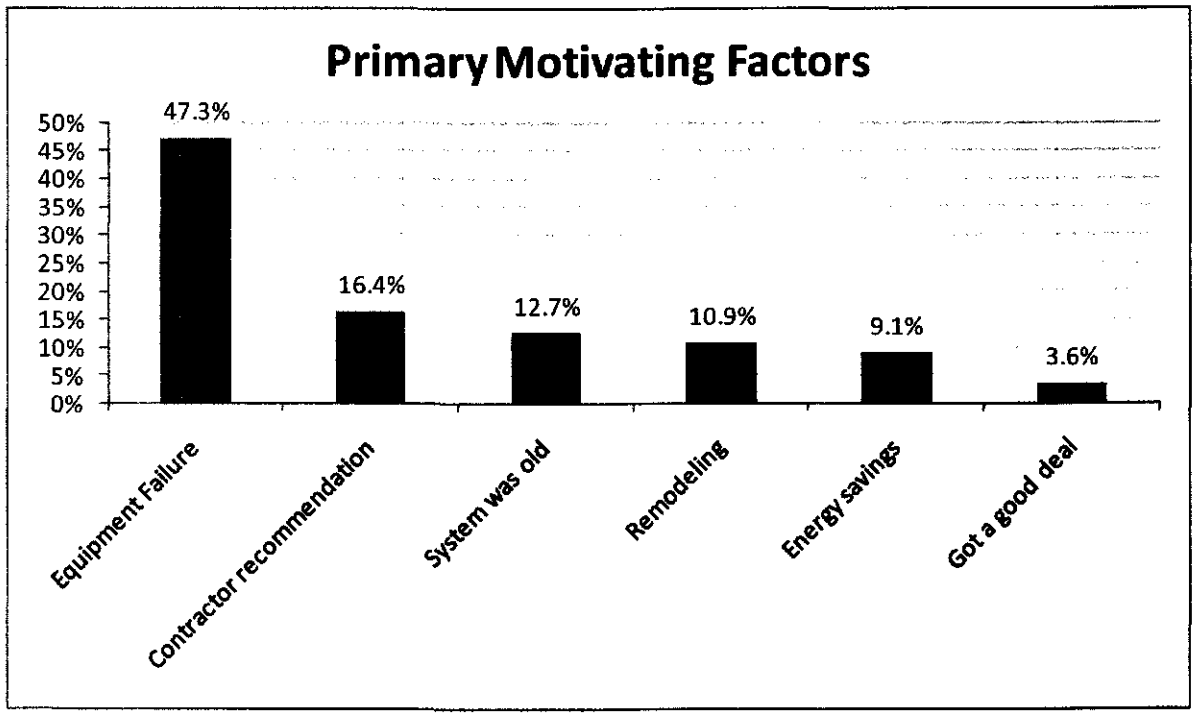

Figure 2. Primary Motivating Factors to Purchase Current Equipment (n=55)

Condition of Technology Being Replaced

Participants were asked if the technology they were replacing was in working condition or worn out and in need of repair. Thirty-eight participants indicated that their old unit was either worn out or in need of repair and 14 said that their unit was in working condition. Those participants were then asked to estimate the remaining lifespan of the equipment that was replaced. The estimated average remaining life of the equipment in working condition is 3.9 years with a range of six months to ten years.

Incentive Forms

Three of the 55 survey participants indicated that they filled out the Residential Smart $aver® forms. These three participants reported no difficulty in understanding or completing the application forms.

Wait Time for Incentive

The length of time that passes from when the application forms are submitted, to the arrival of the rebate check are described as reasonable and free of problems by all 55 survey participants.

Free Ridership

Participants were asked how important the program rebate was to their decision to purchase a more energy efficient model. The results are shown in Figure 3. One participant (1.9%) indicated that the rebate was the primary reason and five participants (9.3%) regarded the rebate as unimportant or minor in their consideration. Fifteen participants (27.3%) regarded the rebate as

important, and thirty-three participants (61.1%) said that the rebate was one of the reasons, but not the most important.

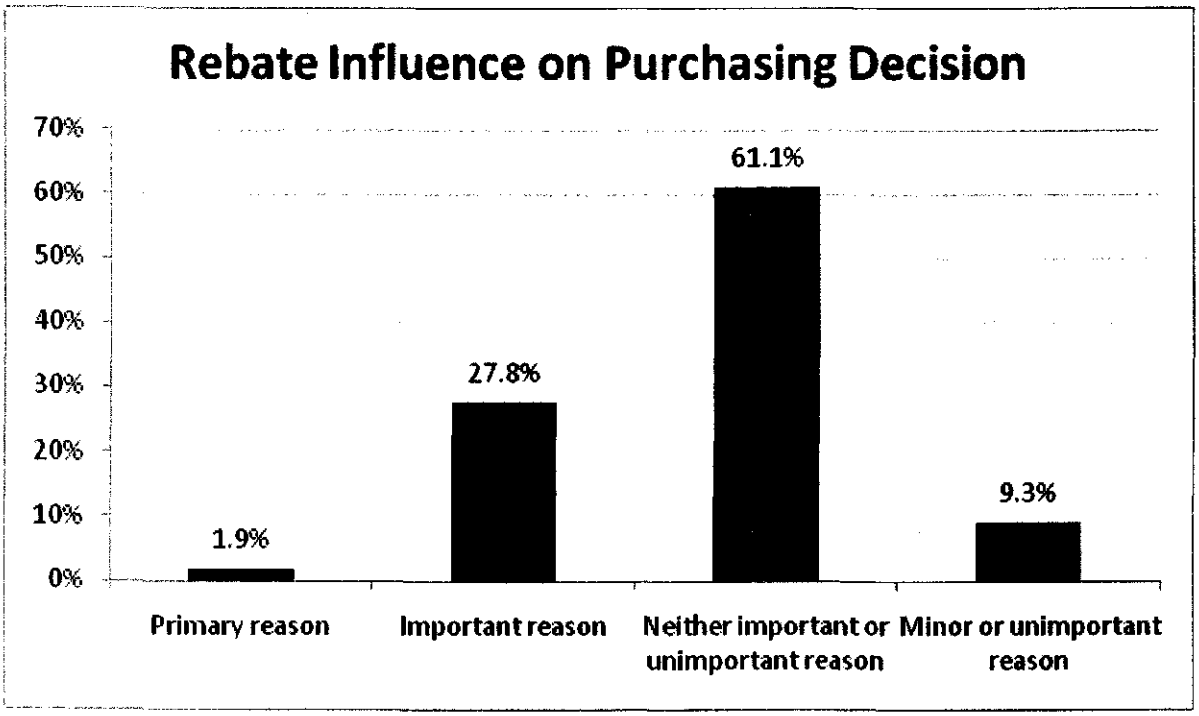

Figure 3. Rebate Influence on Purchasing Decision (n=54)

Surveyed participants were asked if the rebate had not been available whether they would have purchased the same measure or an equally energy efficient one. Customers were also asked about the timeline associated with their purchase to determine if the change would have been made, but at a later time. In addition, only two out of 54 surveyed participants indicated that they would have delayed the purchase of equipment without the program. One participant thought the delay would be three to four months and the other thought he or she would have waited six months to purchase new equipment.

Survey participants were read the following statement in order to rate the amount of influence the rebate had on their purchasing decision: "I would like to ask how important the program incentive was in your decision to buy the more energy efficient model. Would you say the incentive was..."

Possible responses were weighted for free ridership and included the following:

- The primary reason (no free ridership)
- An important reason (20 percent free ridership)
- Neither an important or unimportant reason (40 percent free ridership)
- An unimportant reason (80 percent free ridership)

- Not a reason at all (100 percent free ridership)

The free ridership multiplier from each rating is then multiplied by the percentage of respondents who chose that rating. The sum of the products of the percentages and multipliers is the unadjusted free ridership percentage.

The unadjusted free ridership percentage is calculated using Table 1. The overall free ridership is calculated to be 37.4 percent with a net to gross ratio of 62.6 percent (100 percent minus 37.4 percent.)

Table 1. Free Ridership Percentages

Amount of Rebate Influence	Free Ridership Multiplier	Number of Respondents	Percent of Respondents	Adjusted Free Ridership Ratio
Primary reason	0 percent	1	1.9%	0 %
Important reason	20 percent	15	27.8%	5.6%
Neither Important or Unimportant reason	40 percent	33	61.1%	24.4%
Unimportant reason	80 percent	5	9.3%	7.4%
Not a reason	**100 percent**	**0**	**0%**	**0%**
Sum			**100%**	**37.4%**

The field of net to gross analysis is subjective in that it asks about counter factual intentions and actions after the fact. Current literature documents that participants who consider a purchase a wise decision tend to take credit for that decision (rather than give credit to the program). Likewise, when a decision results in an outcome that is less desirable than expected, participants tend to credit that decision to someone or something else (such as the program). Because project upgrades save energy, save money and improve the environment, key reasons noted by the respondents for their participation decision, there is a tendency for them to report higher free rider scores. As a result, we consider the free rider score reported in this study to be conservative because it was obtained from participants following a decision event. In a previous study of this program (TecMarket Works 2008) we estimated free ridership using a different approach. In the previous study we interviewed dealers and contractors and asked them to make estimates of their customer's free rider condition. That finding was almost identical (37.2% in 2008 versus the current study's 37.4%). Because these two different approaches that were conducted at different times yet for the same program provide almost identical findings, we are not adjusting the current study's free ridership score down to reflect the decision bias described in the evaluation literature. The fact that the two scores are essentially identical supports the findings of both studies.

Surveyed participants were then asked an unprompted question as to what other factors besides the rebate that prompted them to buy the more energy efficient product. Thirty participants mentioned reducing energy costs as a reason (55%), five participants mentioned environmental concerns or wanting to "go green", three participants said their equipment was recommended by a friend, three said that comfort was a factor in their decision, two cited reliability, and one participant said the unit they purchased was recommended in a package by the contractor.

Spillover

Surveyed participants were also asked if they had taken any additional energy efficient steps as a result of the Residential Smart $aver® program. Thirteen out of fifty-five participants (24%) indicated they had taken additional steps.

- Six participants stated that they recycled more after participating in the program.
- Three participants said that they had improved their insulation.
- One participant installed a new roof and doors.
- One participant bought a hybrid vehicle.
- One participant installed triple pane windows.
- One participant bought an Energy Star dishwasher.

What About Residential Smart $aver® Works Well

Each surveyed participant was asked what they think works well about the program. Thirty-seven participants cited the incentive as what they liked the most. Seven participants cited the new equipment's savings on their utility bills, five cited the good feeling they received from going green, three thought the quickness of the rebate worked very well, three cited the quality of their new equipment, and two participants said the ease of use was their favorite part of the program.

Table 2. Residential Smart $aver® Positively Viewed Components

Positively viewed component	N	Percentage
Incentive	37	68.5%
Energy savings	7	12.8%
Altruism – going green	5	9.1%
Rebate delivery time	3	5.4%
Quality of new equipment	3	5.4%
Ease of use	2	3.6%

Increasing Participation

Surveyed participants were asked whether they thought certain suggested changes to the program operations would increase participation in Residential Smart $aver®. The potential changes and the surveyed participants' responses are shown in Figure 4. An increase in general advertising and the incentive amount were thought of as effective strategies by a majority of survey respondents – over 70 percent for each.

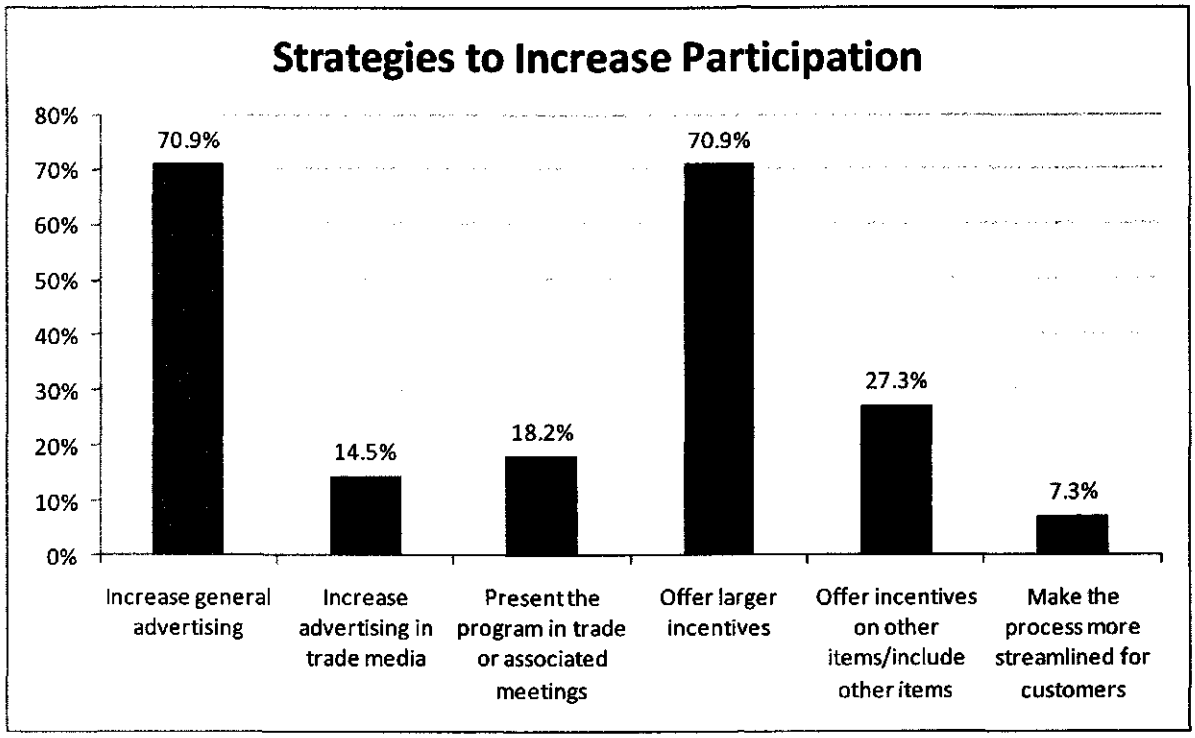

Figure 4. Strategies to Increase Participation in Residential Smart $aver®

What Should Change About Residential Smart $aver®

Surveyed participants were asked what they would like to see changed about the Residential Smart $aver® program. Twelve surveyed participants mentioned that the cost of energy efficient equipment was still too high and they would like to see it lowered. One customer said that because of his tax situation, he was not able to get the full refund and would have liked to have known about that contingency beforehand.

Trade Ally Interview Results

The eight Residential Smart $aver® trade allies were interviewed in June 2010. All of the interviews were conducted with a sales manager within the firm or an equivalent representative. Each of the respondents indicated that they are the individual within their company who has the most experience and is the most acquainted with the program. The interview protocol used during these interviews can be found in Appendix B: Residential Smart $aver® Contractor Interview Instrument.

The interviews were written to cover various aspects of the program, such as program operations, aspects of trade allies' involvement, incentive levels applied, covered technologies, and program effects from the trade allies' perspectives. The results of the process interviews are reported by the response categories presented below.

Program Materials

We asked the trade allies if they had enough program materials such as brochures, applications, and program documentation to effectively sell the program to their customers. All eight trade allies indicated that they had enough program forms and applications but thought that Duke Energy needed to provide more marketing materials. Three of the eight trade allies said that they had never seen any marketing material from Duke Energy about the Residential Smart $aver® program.

Problems That Have Come Up

All trade allies interviewed said that their experiences with the program were free of any problems and that they were pleased with the program.

When asked about customer complaints from the trade allies' perspective, trade allies reported that there have been very few customer complaints. Three trade allies reported that there was some confusion as to whether certain customers were eligible for the Residential Smart $aver® rebate based on whether they received both electricity and natural gas service from Duke Energy.

Wait Time for Incentive

The length of time that passes from when the application forms are submitted, to the arrival of the rebate check are described as reasonable by all eight trade allies. The stated average length of time to wait for a rebate check varied very little from 2 to 3 weeks. While this evaluation did not confirm the wait times by reviewing the application dates and the date of the rebate distributions, past experience in these types of studies indicate that contractors and customers expect rebates to be promptly processed and paid.

What About Smart $aver® Works Well

Each interviewed trade ally was asked what they think works well about the program. This question was then followed with a question about what changes should be made to the progam. The trade allies responded to the question of what works well about the program with a variety of responses. Five out of eight trade allies mentioned ease of use and ease of forms as an aspect of Smart $aver® that works well. Further, two trade allies noted that the ease of forms allowed them to maximize their time selling equipment rather than filling out forms. Specific responses include:

- "The rebate checks get out fairly quick."
- "We like it all. In this economy the bottom line is what counts."
- "It's not a hassle and money gets to customers quickly."

All trade allies interviewed see the program as a way to encourage customers to upgrade their air conditioning or heat pump to a higher efficiency level.

What Should Change About Residential Smart $aver®

The responses to the question of what should be changed varied among the trade allies, with some vendors providing multiple responses. One of the common responses received is that trade allies would like to submit online applications, although it was noted that the form process currently works well. Three vendors noted that an easier way to identify ineligible customers would be a welcome change.

Communications with Duke Energy Staff

All of the trade allies interviewed said that communication with Duke Energy staff was fine, though limited. All trade allies said that they were very satisfied with his responses to their questions.

Customer Awareness of Residential Smart $aver®

Trade allies were asked how they made customers aware of the Smart $aver® program and then to describe the customers' initial reaction to the program.

All of the trade allies said they tell their customers about the program during normal sales communications and present it as a way to achieve savings on their utility bills as well as their upfront costs. All trade allies said that customers respond positively to the idea of the incentive.

Five of the eight trade allies said that the majority of their customers were not aware of the Smart $aver® program before it was presented to them by the trade ally.

Why Trade Allies Participate

Why trade allies participate varies from the basics (increased sales/profit) to the altruistic (doing the right thing for their customers). Trade allies' individual responses include:

- "It's a great sales tool."
- "It's a win/win/win. Plus, we try to be green in our business and this helps our image in that area."
- "Our bottom line doesn't change too much, but it allows us to offer more options to our customers."
- "In this economy, people are doing the math. The more you can save them in every area, the better."

Program Technologies and Incentives

We also talked to the trade allies about the technologies offered in the program, and the incentives that are provided. The technologies covered and incentives provided through the Residential Smart $aver® program are supported by everyone we spoke with.

Technologies and Equipment Covered
All eight trade allies interviewed thought that no technologies currently covered by the program should be removed.

Incentive Levels
All trade allies interviewed indicated that they were satisfied with the current incentive levels. One trade ally noted that in a down economy any rebate level is much more important since buying an air conditioner is not always a necessity and it's a question of whether or not to buy the equipment rather than which model or SEER to buy. Half of the trade allies stated that more rebate is always better, but they are satisfied with current levels.

Other Technologies That Should Be Included
Trade allies mentioned two technologies that they thought should be considered for the program – ductless air conditioning and on-demand water heaters. Three trade allies mentioned ductless air conditioners, and one mentioned on-demand water heaters.

How the Trade Allies Bundle Products

Trade allies were asked if they bundled their air conditioners with other efficiency options. Six of the eight trade allies stated that they bundled options with their air conditioners. All six reported that they offered programmable thermostats with all of their air conditioners. Four of the eight trade allies offered duct installation upgrades, two at six inches, one at four inches and one with a customers' choice of four or six inches, two trade allies bundled duct leak sealing and reported using a Retrotec duct leakage tester.

Trade allies were also asked what percentage of their air conditioners included bundled items. The six allies who bundled thermostats indicated that they offered them with 100 percent of air conditioners. For duct installation upgrades and sealing leaks, trade allies had a difficult time assessing a percentage since the bundled prices were available for all air conditioners but whether they were offered depended on the individual customer's needs.

Two trade allies did note that the presence of the rebate allowed them to bundle prices more attractively than products with no rebate.

Suggestions for Streamlining Participation Process

The two suggestions for streamlining the process included the ability to complete the program applications online and having customer eligibility more easily identifiable. Four out of eight trade allies said that an online application would improve their participation experience, and three said streamlining customer eligibility would improve their experience. This could be achieved either by Duke Energy offering an easy way to check for eligibility online or offering the rebate to all Duke Energy natural gas customers regardless of whether or not they receive electricity from Duke Energy.

Program Results

We asked the trade allies about the benefits of their participation in the program to them and to their customers, and how the program has altered their business by changing what equipment they offer. None of the contractors have made significant changes to their marketing strategies because of the program. Their goal is to obtain the best price and quality for their customers. The incentives mean that they can push the energy efficient units at a reduced price allowing more customers to obtain immediate and lasting savings. These findings are consistent with the program theory to increase market penetration via rebates and incentives.

Residential Smart $aver's® Influence to Carry Other Energy Efficient Options

None of the eight trade allies said that the program has resulted in their businesses carrying other energy efficient equipment not covered by the program. Several trade allies did note that they do carry more energy efficient products now than before the program started, but that the increase has more to do with a general move toward energy efficiency rather than the specific program.

However, three trade allies did note that their sales staff has become more knowledgeable about the energy efficient models and items that they carry because of increased interest attributable to the program.

Market Impacts and Effects

Trade allies were asked what percentage of Residential Smart $aver® buyers are replacing older equipment that is still functional or failed units. On average, the eight trade allies indicated that that 27 percent of participants were replacing functional but less efficient equipment, while 73 percent were replacing failed equipment.

Trade allies also indicated that they have fewer calls to correct problems with Smart $aver® appliances, but several allies noted that this may be because of the relative young age of the equipment.

Trade allies had multiple strategies for marketing the Residential Smart $aver® program including stickers, displays, advertising and sales pitches.

Program's Influence on Business Practices

We asked the contractors if their business would change if the Residential Smart $aver® program were no longer offered. We posed the question: *"If the program were to be discontinued, what would happen to the volume of sales of the high efficiency models?"* All eight trade allies indicated that sales would decline. Specific responses include:

- "People would either not get the product at all or go from 14 to 13 or 12 SEER."
- "We would scale back on those units for sure. Hard to say how much until the sales figures come in, but 25-50% is a good ballpark."

All eight of the trade allies said they would change their high efficiency model pricing structure if the program were no longer available.

Continuing Need For The Program

We asked the trade allies if they thought that the program was still needed. All of the interviewed trade allies said yes. All trade allies considered the Residential Smart $aver® program an essential sales tool for energy efficient equipment.

Free Riders

We also asked the trade allies to estimate the level of free riders. Five trade allies felt qualified to answer questions about their customers' level of free ridership. On average trade allies felt that 25 percent of air conditioners and 30 percent of heat pump customers would have still gone with the high efficiency units without the incentive. All five trade allies thought that all customers who purchased the high efficiency unit were influenced by the rebate Duke Energy offered.

Spillover and sales percentage

Trade allies were also asked if the program has influenced their decision to market or sell more high efficiency air conditioners and heat pumps. All eight trade allies said that this was the case. Five trade allies said they increased promotions and displays and three said they educated their sales staff more thoroughly on the incented products.

Lastly, trade allies were asked what percentage of sales were rebated through the Residential Smart $aver® program last year. Four trade allies gave numbers: 5%, 5%, 40%, and 10%.

Appendix A: Smart $aver® Participant Survey Instrument

Hello, my name is <name> with TecMarket Works and I am calling in regard to the rebate that you received from Duke Energy's Smart $aver® program. The purpose of this call is to ask you a few questions about your purchase and your satisfaction with the application and rebate. We are not selling anything. The survey will take about 5-10 minutes and your answers will be confidential, and will help us to make improvements to the program to better serve others. May we begin the survey?

1. Our records indicate that you participated in the Smart $aver® Program in <date> and that you installed <technology> through the program and received an incentive for your purchase. Do you recall participating in this program?

1. ❑ Yes, *begin* — *Skip to Q2.*
2. ❑ No,
99. ❑ DK/NS

1a. **This program was provided through Duke Energy. In this program, you purchased an energy efficient** <air conditioner or heat pump>. **In exchange for purchasing the energy efficient option, Duke Energy provided you with a rebate check for $**<amount>.

Do you remember participating in this program?

1. ❑ Yes, *begin* → *Go to Q2.*
2. ❑ No,
99. ❑ DK/NS

If No or DK/NS terminate interview and go to next participant.

2. **How did you become aware of the Smart $aver® Program?**
   - **a.** ❑ Duke Energy sent me a brochure
   - **b.** ❑ Duke energy website.
   - **c.** ❑ A contractor I was working with told me about the program
   - **d.** ❑ An equipment supplier
   - **e.** ❑ I saw an ad in _____
   - **f.** ❑ Other _____
   - **g.** ❑ DK/NS

3. **When you first heard about the program and considered taking advantage of the offer, did you do any additional investigation to confirm the program's offering, or was the information you had adequate to make a participation decision?**

a. ❑ The information was adequate
b. ❑ Didn't need to confirm/Nothing
c. ❑ Went to the web site
d. ❑ Called or emailed Duke Energy
e. ❑ Called or emailed a contractor
f. ❑ Called or emailed a salesperson
g. ❑ Other: _____
h. ❑ DK/NS

If c, d, e, f, g: **4. How well did this work for you, were you able to acquire a more complete understanding of the program?**

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

5. Did you have additional questions that were not answered? Were there questions that you were unable to answer or information that you were unable to obtain?

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

5a. What were they?

_____

_____

6. **Who filled out the program incentive forms?**
   a. ❑ I did
   b. ❑ Someone from my family did
   c. ❑ The contractor
   d. ❑ The salesperson
   e. ❑ Someone from Duke Energy

7. **Who submitted the forms to Duke Energy?**
   a. ❑ I did
   b. ❑ Someone from my family did
   c. ❑ The contractor
   d. ❑ The salesperson
   e. ❑ Someone from Duke Energy

8. *If they filled it out.* **Was the incentive form easy to understand?**

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

If not, 8b. **Do you remember what it was that was not clear or which part of it was difficult?**

_____

_____

9. **Did you have any problems receiving the rebate?**

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

If yes, 9b. **Please explain the problem and how it was resolved. Was it resolved to your satisfaction?**

_____

_____

10. **Did you originally plan on purchasing the exact same efficiency level in the equipment you purchased before you knew that there was a rebate offered by Duke Energy?**

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

11. **In your decision process, did you search for or consider other, less energy efficient equipment that might have cost less?**

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

12. **What was the primary reason that you decided to purchase or upgrade your equipment?**

1. ❑ Remodeling
2. ❑ Equipment failure
3. ❑ Contractor recommendation
4. ❑ Energy Savings
5. ❑ Got a good deal
6. ❑ It was an old system
7. ❑ Combination of above: *list*: _____

13. **When you decided to replace your air conditioner or heat pump, what was the condition of the unit? Was it:**
    a. ❑ **Still functional or repairable**
    b. **or** ❑ **Worn out and in need of replacement**

If still functional or repairable, how many more cooling seasons would you estimate the unit would have run before it needed to be replaced?

Record number: _____

14. **I would like to ask how important the program incentive was in your decision to buy the more energy efficient model. Would you say the incentive was...** *(read and check the best response).*

a. ❑ **The primary reason why you purchased the high efficiency model,**
b. ❑ **An important reason, along with other reasons,**
c. ❑ **One of the reasons, but it was not the most important,**
d. ❑ **One of the reasons, but it was a minor or unimportant reason, or**
e. ❑ **It was not a reason at all,**
f. ❑ DK/NS.

15. **If the rebate were not available from the program, would you have delayed your purchase, or would you have made the purchase at the exact same time?**

a. ❑ The purchase would have been delayed – **How long do you think you might have waited to make the purchase?** _____
b. ❑ The purchase would have been made at the same time
c. ❑ DK/NS

16. **Were there other reasons in addition to the rebate that you went with the high efficiency** <technology> **instead of something less expensive to purchase?**

_____

_____

17. **When customers have experience with energy efficiency programs or products they sometimes make similar decisions to continue the energy savings in other parts of their homes or work places. Have you taken any other energy efficiency actions that may have been, in some way, influenced by your experiences with Duke Energy's Smart $aver® program?**

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

a. *If yes,* **What have you done?** *list:* _____
b. *If yes,* **How much money do you think you have saved as a result?**

_____

_____

I would like to ask you a few questions about the design of your home. The answers to these questions will help Duke Energy better estimate the energy savings resulting from your high efficiency air conditioner or heat pump upgrade.

18. Is your home built over a:

- ❑ **crawlspace,**
- ❑ **slab on grade or a**
- ❑ **basement**
- ❑ Other or Don't Know

19. Does the duct work in your home run primarily through:

- ❑ **interior walls**
- ❑ **crawlspace**
- ❑ **attic, or the**
- ❑ **basement**
- ❑ Other or Don't Know

20. Does your home have a programmable setback thermostat?

❑ Yes ❑ No ❑ Don't Know

21. One of the objectives that the program would like to meet over the next year is to increase participation. Can you think of things that the program can do to help increase participation or help increase interest from people like yourself?

a. ❑ Increase general advertising
b. ❑ Increase advertising in trade media
c. ❑ Present the program in trade or associated meetings
d. ❑ Offer larger incentives
e. ❑ Offer incentives on other items/include other items
f. ❑ Have program staff call residential customers
g. ❑ Make the process more streamlined for customers
h. ❑ Make the process more streamlined for contractors
i. ❑ Other: _____

22. **During your participation process, did you need to contact Duke Energy to obtain information about the program?**

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

If yes, 22b. **Were your questions or needs effectively handled by the Duke Energy?**

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

If no, 22c. **How might this be improved?**

_____

_____

23. Overall, what did you like most about the Smart $aver® Program?

_____

_____

24. **What did you like least?**

_____

_____

We would like to ask you a few questions about your satisfaction with the program. For these questions we would like you to rate your satisfaction using a 1 to 10 scale where a 1 means that you are very dissatisfied with the program and a 10 means that you are very satisfied.

25. How would you rate your satisfaction with.

a. The amount of the rebate provided by the program

1 2 3 4 5 6 7 8 9 10

b. The ease of filling out the form to receive the rebate

1 2 3 4 5 6 7 8 9 10

c. The time it took for your to receive your rebate check

1 2 3 4 5 6 7 8 9 10

d. The number and kind of technologies covered in the program

1 2 3 4 5 6 7 8 9 10

e. The information you were provided explaining the program

1 2 3 4 5 6 7 8 9 10

For each item above that received a score of 8 or less ask:
21a. What could have been done to make this better?

For item a: The amount of the rebate provided by the program

_____

_____

For item b: The ease of filling out the form to receive the rebate

_____

_____

For item c: the time it took for you to receive your rebate check

_____

_____

For item d: the number and kind of technologies covered in the program

_____

_____

For item e: the information you were provided explaining the program

_____

_____

22. Considering all aspects of the program, how would you rate your overall satisfaction with the Smart $aver® Program?

1 2 3 4 5 6 7 8 9 10

If score is 8 or less ask: **What could have been done to make your experience better, or have we already covered it?**

_____

_____

Thank you, we have reached the end of the survey. Do you have any comments that you would like for me to pass on to Duke Energy?

1. ❑ Yes: _____

2. ❑ No

Thank you for your time, have a nice day/evening/weekend.

Appendix B: Residential Smart $aver® Contractor Interview Instrument

Name: _____

Title: _____

Position description and general responsibilities:

_____

_____

_____

We are conducting this interview to obtain your opinions about and experiences with Duke Energy's Smart $aver® program. We'll talk about your understanding of the Smart $aver® Program and its objectives, your thoughts on improving the program, and the technologies the program covers. The interview will take about an hour to complete. May we begin?

Understanding the Program

We would like to ask you about your understanding of the Smart $aver® program. We would like to start by first asking you to…

1. Please review for me how you are involved in the program and the steps you take in the participation process. Walk me though the typical steps you take to help a customer become eligible for this program and what you do to receive or help the customer receive the program incentive.

2. What kinds of problems or issues have come up in the Smart $aver® program?

3. Have you heard of any customer complaints that are in any way associated with this program? Have callbacks increased due to the program technologies?

Program Design and Design Assistance

4. Do you feel that the proper technologies and equipment are being covered through the program?

5. Are the incentive levels appropriate? How do they impact the choice by the customers of the higher efficient equipment?

6. Are there other technologies or energy efficient systems that you think should be included in the program?

7. Are there components that are now included that you feel should not be included? What are they and why should they not be included?

Reasons for Participation in the Program

We would like to better understand why contractors become partners in the Smart $aver® Program.

9. How long have you been a partner in the Smart $aver® Program?

10. What are your primary reasons for participating in the program? Why do you continue to be a partner?.... *If prompts are needed...* Is this a wise business move for you, is it something you believe in professionally, does it provide a service to your customers, do you want to build a relationship with Duke Energy, or other reasons?

11. Has this program made a difference in your business? How?

12. How do you think Duke Energy can get more contractors to participate in this program?

Program Participation Experiences

The next few questions ask about the process for submitting participation forms and obtaining the incentive payments.

13. Do you think the process could be streamlined in any way? How?

14. How long does it take between the time that you apply for your incentive, to the time that you and your customer receive the payments? Is this a reasonable amount of time? What should it be? Why?

15. Do you have the right amount of materials such as forms, information sheets, brochures or marketing materials that you need to effectively show and sell your Smart $aver® heat pumps and air conditioners? What else do you need?

16. Overall, what about the Smart $aver® Program do you think works well and why?

17. What changes would you suggest to improve the program?

18. Do you feel that communications between you and Duke Energy's Smart $aver® program staff is adequate? How might this be improved?

19. What benefits do you receive as a result of participating in Duke Energy's Smart $aver® Program or from selling Smart $aver® items?

20. What do you think are the primary benefits to the people who buy a Smart $aver® appliance? Are there other benefits that are important to a potential customer?

Market Impacts and Effects

21. How do you make customers aware of the Program?

22. Are customers more satisfied with this equipment? Why or why not?

23. Do you have fewer calls or more calls to correct problems with the Smart $aver® appliances?

24. Do you market or sell the Smart $aver® equipment differently than your other equipment? How?

25. What percent of Smart $aver® buyers do you think are replacing older equipment that is still functioning, but less efficient? What percent of Smart $aver® buyers do you think are replacing failed units?

26. Other than the energy efficient heat pumps and air conditioners, has the program influenced you to carry other energy efficient equipment that is not rebated through the program?

    a. *If yes*, what do you now carry?

    b. *If yes,* About how many of these units did you install/sell in the last year?

27. Do you bundle air conditioners with any other efficiency options?
    a. If yes, what percent?

28. Set back thermostats?
    a. If yes, what percent?

29. Duct insulation upgrades?
    a. If yes, what percent?
    b. R Value or inches?

30. Sealing leaks in duct work?
    a. If yes, what percent?
    b. What instruments were used to assess leakage, apply sealing, or measure effectiveness?

Heat Pump Questions

31. Has the program influenced your decision to market or sell more high efficiency heat pumps than you would have without the program?

    a. *If yes,* To what extent?

32. Of those Energy Efficient heat pumps that were rebated through the program, what percent of those customers do you think would have still gone with an energy efficient model if the Duke Energy rebate were not available?

33. What percent of these customers do you think were in some way influenced by the rebate Duke Energy offered?

34. What percent of your total high efficiency heat pump sales were rebated through the Smart $aver® program last year?

Central Air Conditioner Questions

35. Has the program influenced your decision to market or sell more high efficiency air conditioners than you would have without the program?

    a. *If yes,* To what extent?

36. Of those energy efficient central AC units that were rebated through the program, what percent of those customers do you think would have still gone with an energy efficient model if the Smart $aver® rebate were not available?

37. What percent of these customers do you think were in some way influenced by the rebate Duke Energy offered?

38. What percent of your total high efficiency central AC sales were rebated through the Smart $aver® program last year?

We would like to know what your practices were before you became a partner in the program, and what you would offer your customers without the program.

39. There are no plans to terminate the program, but we would like to know how the program effects contractors. If the program were to be discontinued, would you still offer the same energy efficient equipment options?

40. If the program were not offered, how would you structure pricing differently to make up for the program loss?

41. In your opinion is the Smart $aver® program still needed? Why?

Recommended Changes from the Participating Contractors

37. Are there any other changes that you would recommend to Duke Energy for their Program not already discussed?

Appendix C: Program Manager Interview Protocol

Name: _____

Title: _____

Position description and general responsibilities:

_____

_____

_____

We are conducting this interview to obtain your opinions about and experiences with the Smart $aver® and Summer Saver programs, which I will refer to as one program, the Smart $aver® program. We'll talk about the Smart $aver® Program and its objectives, your thoughts on improving the program, and the technologies the program covers. The interview will take about an hour to complete. May we begin?

Program Objectives

1. In your own words, please describe the Smart $aver® Program's current objectives. How have these changed over time?

2. In your opinion, which objectives do you think are best being met or will be met?

3. Are there any program objectives that are not being addressed or not being addressed as well as possible or that you think should have more attention focused on them? If yes, which ones? How should these objectives be addressed? What should be changed?

4. Should the program objectives be changed in any way due to technology-based, market-based, or management based conditions? What objectives would you change? What program changes would you put into place as a result, and how would it affect the operations of the program?

Operational Efficiency

5. Please describe your role and scope of responsibility in detail. What is it that you are responsible for as it relates to this program?

6. Please review with us how the Smart $aver® operates relative to your duties, that is, please walk us through the processes and procedures and key events that allow you do currently fulfill your duties.

7. Have any recent changes been made to your duties? If so, please tell us what changes were made and why they were made. What are the results of the change?

8. Describe the evolution of the Smart $aver® Program. How has the program changed since it was it first started?

9. Do you have suggestions for improvements to the program that would increase participation rates or interest levels?

10. Do you have suggestions for improving or increasing energy impacts?

11. Do you have suggestion for the making the program operate more smoothly or effectively?

Program Design & Implementation

12. *(If not captured earlier)* Please explain how the interactions between the contractors, customers, and Summer Saver's management team work. Do you think these interactions or means of communication should be changed in any way? If so, how and why?

13. How do you determine which heat pumps and air conditioners are included in the program? How do you determine what efficiency levels should be placed in the program for heat pumps and central AC units? What should be changed about this selection process? Do you think this would result in more contractors and/or customers participating in the program?

14. Describe your quality control and tracking process.

15. Are key industry experts, trade professionals or peers used for assessing what the technologies or models should be included in the program? If so, how does this work?

16. Are key industry experts and trade professionals used in other advisory roles? If so how does this work and what kinds of support is obtained?

17. Describe Smart $aver®'s contractor program orientation training and development approach. Are contractors getting adequate program training and program information? What can be done that could help improve contractor effectiveness? Can we obtain training materials that are being used?

18. In your opinion, did the incentives cover enough different kinds of energy efficient products?

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

If no, 20b. What other products or equipment should be included and why?

_____

_____

19. What market information, research or market assessments are you using to determine the best target markets or market segments to focus on?

20. What market information, research or market assessments are you using to identify market barriers, and develop more effective delivery mechanisms?

21. Overall, what about the Smart $aver® program works well and why?

22. What doesn't work well and why? Do you think this discourages participation or contractor interests?

23. Can you identify any market, operational or technical barriers that impede a more efficient program operation?

24. In what ways can these operations or operational efficiencies be improved?

25. In what ways can the program attract more participants?

26. How do you make sure that the best information and practices are being used in Smart $aver® operations?

27. *(If not collected above)* What market information, research or market assessments are you using to determine the best target markets and program opportunities, market barriers, delivery mechanisms and program approach?

28. Are there any other issues or topics you think we should know about and discuss for this evaluation?

Process and Energy Impact Evaluation of the Power Manager® Program in Ohio

Final Report

Prepared for
Duke Energy
139 East Fourth Street
Cincinnati, OH 45201

February 24, 2011

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Summary of Findings

Impact Summary Tables

Power Manager Ohio Savings Terms FINAL				
Program Option	Gross Ex ante	M&V Sample Gross Savings	Derating Factor*	Verified Gross Savings
	(a)	(b)	(c)	(c)
75% (1.5 kW)	1.5	1.43	0.93	1.33
50% (1.0 kW)	1.0	1.06	0.93	0.99

* The derated factor is based on the Operability Study

Program	Cycle Option	Participation Count	Switches associated with each participant	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings
Power Manager	75%	31,220	1.09	0	1.33	0	41,564
Power Manager	50%	31,220	1.09	0	0.99	0	30,810

Customer Satisfaction

- Satisfaction with the Power Manager® program is high with over half of the survey respondents rating their satisfaction at 10 on a 10-point scale for all program aspects: Overall program, program enrollment, and program information.

Motivating Factors

- Fewer than half (46.2%) of the surveyed Ohio participants were able to recall any benefits promoted by the program. In Kentucky, 38.5% were able to recall at least one benefit promoted by the program. However, the surveyed participants that did recall program benefits were able to provide 95 benefits that they recalled being promoted by the program. Of the 95 benefits recalled by these participants, 61% of them mentioned money either by recalling the bill credits or financial incentives for participating in the Power Manager® program.

- Most participants rate environmental issues as important or very important to them. However, a small number of them (about 6%) are a member of an organization with an environmental mission.

- Many of the participants do not know when control events occur, or even notice the bill credits on their bill. However, the bill credits are the most commonly cited reason for their participation in the program.

Recommendations

- Bring on additional staff to help answer phone calls and email during events, and to assist with the administrative needs. Although the interviewees state that Duke Energy's management is aware of the need for more staffing, it is worth emphasizing this need. Demand response programs usually only a have a few opportunities each year in which they are visible to the customer and it is critical to ensure that program operations run efficiently in the eyes of the participant during those times, and that all customer concerns during events are addressed promptly. While the Power Manager® team has succeeded with their existing staffing, interviewees express concern that their ability to respond to customer concerns during events may affect their ability to provide technical oversight of the event once it's initiated.

- In program planning, consider estimating the number of economic events separately from emergency events. Currently, regulators and customers are told to expect approximately 10 events a year, while more may be called if emergency conditions warrant. However, in 2010, the Retail Energy Desk had called 8 economic events by August and were hesitant about calling more economic events in order to reserve the last two events for emergency calls. Economic events are called in order to prevent ratepayers from being negatively affected by fluctuations in energy cost. If this avoidance is truly of value, then the decision to make an economic call should be made for economic reasons. The prospect of possible emergency events should not be factored into economic call decisions, because whether an emergency occurs or not cannot be factored into planning. Estimating economic events separately from emergency events may also enable stakeholders to better understand the different benefits of each category of demand response.

- Consider leapfrogging the Cannon switch technology in favor of a switch that allows two-way communication, or one that can be integrated with a smart grid. The majority of the costs of upgrading the inoperable and old switches is likely to be due to the labor needed to install the switches. The completion date for the switch upgrade is currently projected to be in two years. By that time, it is likely that the Cannon switches will be more out of date. Duke Energy staff have expressed a need for two-way communications in order to achieve effective program management and savings acquisition.

Introduction

This document presents the evaluation report for Duke Energy's Power Manager® Program as it was administered in Ohio and Kentucky.

The evaluation was conducted by TecMarket Works with assistance from Integral Analytics and Yinsight. The survey instruments were developed by TecMarket Works. The survey was administered by TecMarket Works. The impact analysis was conducted by Duke Energy staff, and reviewed by Integral Analytics. Yinsight (a TecMarket Works subcontractor) conducted the in-depth interviews with program management.

Methodology

This section presents the approach for conducting this assessment.

Participant Surveys

TecMarket Works developed a customer survey for the Power Manager® Program participants which was implemented in November 2010 after they experienced control events over the summer of 2010.

The complete survey was conducted with a random sample of 101 Power Manager® participants, 75 in Ohio and 26 in Kentucky. There were 80 Ohio customers willing to participate in the survey, but only 75 were able to complete the full survey. The responses from the 80 surveyed Ohio participants are included in the analysis if they provided responses to the specific question. These participants were surveyed by TecMarket Works. The survey can be found in Appendix B: Participant Survey Instrument.

Program Impact Estimation

The impact evaluation for the Power Manager® (PM) program was conducted by Duke Energy Staff working with and reviewed by Integral Analytics staff. The impact evaluation developed an AC duty cycle model based on information from a sample of Power Manager® participants in Ohio, the Carolinas, and Kentucky. This duty cycle was then used to simulate the connect load during the Power Manager® event days under peak normal weather conditions for different PM program options and load control technologies to produce estimates of the potential load reduction. These estimates were then de-rated by the results of the 2010 operability study to give estimates of the realized load reductions. Table 1 below summarizes the resulting estimated actual and the peak normal weather load impacts at the switch level for customers in Ohio:

Table 1. Ohio Load Impacts

Control Strategy	2010 Impacts	Peak Normal Weather Impacts
TC 1.5	1.37	1.33
TC 1.0	0.98	0.99

This general approach is well established in the industry and the actual analysis was very thorough and well thought out. There is little reason to doubt that the resulting impact estimates are reasonable and accurate. A potential alternative approach for future impact evaluations is to use the data from the M&V (and possibly the operability) sample to directly estimate impacts via statistical models. This approach could use a time-series, cross-sectional analysis where the dependent variable is the actual AC load (or run time), and the independent variables include weather conditions, time of day, day of week, and the Power Manager® control event. In essence, this would produce an overall duty-cycle model, and the coefficient on the Power Manager® control event variable(s) would estimate the actual load impacts during those events.

Power Manager® Research

Duke Energy has a Power Manager® research division that that is responsible for two main studies, the results of which are used in calculating program impact. One study is an AC duty cycle study, to estimate load shed potential under a variety of conditions. The other is an operability study, to estimate the number of switches that are operating properly.

Section 1: Impact Analysis

M&V Samples

The 2010 Power Manager® (PM) M&V sample in the Midwest consists of 129 households with 143 air-conditioner (AC) units. This includes 42 households from Ohio, 18 households from Kentucky, and 69 households from Indiana, closely reflecting the relative numbers of PM participants in each state in February, 2010. The 2010 Midwest M&V sample has 27 new households randomly selected from the PM population in February, 2010, and 102 holdovers from the 2009 M&V sample that were randomly selected in either 2008 or 2009.

PM M&V samples are stratified into high and low groups according to premise monthly kWH usage from the previous summer. The Dalenius-Hodges technique for selecting strata boundaries and the Neyman method for optimum sample allocation were employed to achieve reduced sample variance of load reduction estimates. The resulting stratification of PM M&V samples is shown in Table 2.

Table 2. M&V Sample Stratification

	Midwest	
	High	Low
Sample allocation	63	66
Population weight	33.3%	66.7%

M&V Data Collection

Hourly run-time of AC units in the M&V samples was collected during 2010 summer months (May through September). This was accomplished with Cannon load control devices, which record hourly run-time (in minutes) of the AC unit to which they are attached. At households selected for the M&V sample, any older load control device was replaced by a Cannon load control device for this purpose. The purpose of this study is to determine the load reduction achieved when the load control device functions as expected, so this device replacement does not introduce bias into our results. Completely separate operability studies are conducted to determine deviation from expected performance (the de-rating factor) for each load control technology. Two rounds of data collection from M&V Cannon devices were conducted in July and October. In addition to hourly run-time, the Cannon device scan data includes hourly shed minutes and the contents of many device registers. Information about the AC unit is also recorded, including amp ratings (RLA and FLA).

Households in the M&V samples are equipped with load research interval meters, and 15-minute premise interval usage (kWH) was collected for 2010 summer months. Households in the M&V samples were requested to complete a brief survey on

characteristics related to AC usage and overall premise energy consumption; 75% completed the surveys.

Validation of AC Duty Cycle Data

Hourly AC run-time collected from Cannon M&V devices is compared to corresponding premise interval kWH to verify that it accurately reflects operation of the attached AC unit. The validation process is accomplished through a sequence of computer programs that: 1) convert the hourly A/C run-time data into hourly duty cycle; 2) display time series plots of premise kWh and duty cycle with control over time resolution enabling visual comparison of plot detail; 3) calculate cross-correlation between hourly kWh and hourly duty cycle and display cross-plots of kWh vs. duty cycle. Each run-time data file collected for an AC in the 2010 M&V sample is reviewed in this fashion, and the AC duty cycle is added to the model database when hourly premise kWh provides adequate confirmation.

For 5 AC in the Midwest sample we could not obtain the 2010 data needed to apply validation procedures. Reasons for this include customers leaving the PM program (3), no interval KWH (3), unable to retrieve scan data (3), and Cannon device not installed (1). In the validation process, run-time data was rejected for 11 AC in the Midwest sample. These cases appear to be due to sensitivity issues, where the AC is reported to have no run-time or to be always running. Overall, 2010 hourly duty cycle data was added to the model database for 127 AC from the Midwest sample. Table 3 summarizes the 2010 M&V sample.

Table 3. M&V Sample

	Midwest		
	Ohio	**Indiana**	**Kentucky**
Households	42	69	18
Total AC Units	143		
Missing data	5		
Invalid Data	11		
Final AC Sample	127		
Duty Cycle Models (see below)	125		

AC Duty Cycle Models

Impact estimates during PM load control periods are based upon models developed for the natural duty cycle of M&V AC units. These models are developed from 2010 duty cycle data described in Section 3, and similar duty cycle data from the two prior summers (2008, 2009) for AC units that are holdovers from previous M&V samples. Weekends and holidays are not used in the models, and hours during load control and for the remainder of the day are not used. We were able to develop duty cycle models for AC units at 125 households in the Midwest M&V sample. This is the relevant sample sizes for our load impact results.

Natural duty cycle models are specified and estimated individually for M&V AC units to better capture the unique dependence of duty cycle on temperature and humidity characteristic of each AC unit. A limited dependent variable model specification is adopted for hourly duty cycle, the independent variable in the models. Candidate specifications for dependent variables in the models include temperature averaged over the prior 2-hour, 4-hour, and 6-hour intervals, and a weighted temperature average with declining weights over the previous six hours. Candidate specifications also include similar sets of averages based on temperature-humidity index (THI) and heat index (16-element polynomial). Models are estimated with the SAS procedure QLIM. The dependent variable specification selected for an AC unit is based on fit diagnostics from hourly model fits over the typical load control hours, 2:00–6:00 PM. For the selected model, distinct parameters are estimated in each hour of interest, resulting in a set of hourly natural duty cycle fits for each M&V AC. Model specifications selected for M&V AC units and associated t-values for typical load control hours are listed in Appendix C: Duty Cycle Models for M&V Units.

PM Load Control Strategies

The PM program employs two generic types of load control devices which require somewhat different treatment for load impact evaluation. The newer switch type - Cannon LCR 4700 in OH and KY, and Cannon LCR 5200 in IN - operates with an adaptive control strategy called Target Cycle. For each hour of load control, the Target Cycle switch calculates a unique shed time (or percentage) based on characteristics of the attached AC unit. The older switch type – CSE in IN and KY - uses traditional fixed cycling control, where all devices on the same program shed the same amount of time during the control period. In the Midwest, the principal PM program options are 1.5 kW and 1.0 kW, and Target Cycle switches are configured with these load reduction targets. Fixed cycling devices in the Midwest limit the AC run time to 7.5 minutes (1.5 kW) or 15 minutes (1.0 kW) of each 30-minute control period. Equivalently, PM CSE devices in the Midwest are operated with fixed cycling percentages of 75% (FC 75%) for 1.5 kW, or 50% (FC 50%) for 1.0 kW. Table 4 summarizes PM load control technology and strategy used in different states.

Table 4. PM Load Control Devices and Strategies

Device		Strategy			
	Period	OH		IN / KY	
	(min)	1.5 kW	1.0 kW	1.5 kW	1.0 kW
Cannon	30	TC 1.5	TC 1.0	TC 1.5	TC 1.0
CSE	30			FC 75%	FC 50%
Comverge	15				

Target cycle control puts more functionality in the switch itself. Rated amps of the attached AC unit is entered into the switch at installation, and used to determine connected load for the unit. The switch also records hourly duty cycle of attached AC unit and builds a profile (historical profile) of the expected hourly duty cycle under weather conditions typical for load control. The historical profile can be scaled (globally)

by adjusters included in the commands sent to switches for load control. The connected load and adjusted historical profile are used to calculate hourly cycling percentages for the attached AC unit expected to achieve the appropriate load reduction target (1.5 kW, 1.3 kW or 1.0 kW).

Factors that determine Target Cycle shed percentages for M&V AC units during 2010 control periods are known, except for contents of the historical profile registers on those days. Values in these registers started the season at 100%, and were updated frequently by storing run-time for days with weather conditions similar to a load control day. Historical profiles are available in the scan data collected from M&V devices in July and October. Historical profiles on 2010 control days are determined from the profiles obtained in these data collections, adjusted to reflect the stored days (if any) between the data collection and the control day.

AC Connected Load

Connected load is the average power demand (kW) of a running AC unit over a full cycle. It determines the load reduction (kWH) achieved when AC run time is reduced. Connected load is specified for M&V AC units through the basic engineering formulas,

*Apparent Power (kVA) = (Compressor Amps + Fan Amps) * 230 Volts / 1000*

*Connected Load (kW) = Power Factor * Apparent Power*

Rated amps for the compressor (FLA) and fan (RLA) are typically listed on the AC faceplate.

Power factor in this formula is actually different for different AC units, and even varies somewhat for different cycles of the same unit, increasing at high temperature and humidity. We have analyzed synchronous AC run time and premise interval kWH collected for the M&V samples to determine an appropriate overall power factor within each sample. Our result is 0.82 for the Midwest M&V sample. These power factor values are used to calculate connected loads for impact evaluation. The connected loads determined for M&V AC units are given in Appendix D: Connected Loads for M&V Units.

Simulation Method for PM Impact Evaluation

Simulation with M&V natural duty cycle models is used to determine average load reduction per household within high and low M&V strata during each hour of load control and for each PM cycling strategy. These strata results are combined with the population weights given in Table 2 to estimate average load reduction per household in the PM population. The potential load impacts estimated in this manner represent the load reduction which would be achieved if all switches controlled as expected. Impact results for PM load control in the Midwest are obtained by simulation with the Midwest M&V sample.

The simulation procedure is very similar for the two basic PM control strategies, Target Cycle and fixed cycling. In a fixed cycling simulation, the same specified shed percentage is applied to all AC. At the start of a target cycle simulation, a shed

percentage for the specified hour (and day) of load control is calculated for each AC from information specific to that unit and the load reduction target (1.5 kW or 1 kW). These shed percentages remain the same throughout the simulation. Other than this, the simulation procedure is the same for Target Cycle and fixed cycling.

A single realization in the simulation is generated by a random draw of residuals for each of the M&V natural duty cycle model fits, which are evaluated at the temperature and humidity of the control hour (and day). This gives a set of simulated natural duty cycles appropriate for the control hour. Load reduction for each M&V AC is calculated as follows:

Duty cycle reduction = MAX[Duty cycle - (1 – Shed percentage), 0]

*Load reduction = Connected load * Duty cycle reduction*

For households with multiple AC, realized load reduction is aggregated to the household level by summing load reduction from all household AC. These realized load reductions are averaged within the strata, to produce single realizations of average load reduction per household within both high and low strata. These two sample averages constitute the result from one pass through the simulation corresponding to one draw of model residuals.

Several thousand passes through the simulation are performed to adequately capture the variation in average load reduction within strata that is consistent with our duty cycle models and M&V sample sizes. The results accumulate into distributions of sample averages for both high and low strata. The grand means of these distributions are the most significant output from a simulation run. They are the estimates of average load reduction per household in the high and low strata for the specified control hour and cycling strategy. The spread of these distributions (e.g., variance) characterizes the uncertainty in the load reduction estimates, and is very much affected by our M&V sample sizes.

Load Impact Results

Load impacts described in this section are computed with population estimates of load reduction per switch, rather than load reduction per household. Simulation results are converted to load reduction per switch using the factors 1.090 switches per household for the results. Population estimates of load reduction per household are divided by these factors to get corresponding population estimates of load reduction per switch. The estimates of switches per household are determined from the Midwest M&V samples.

Table 5 through Table 7 illustrate the calculation of load reduction load reduction on a PM event day in a state with 3 different load control technologies. Load impact from CSE devices are developed in Table 5, load impact from Cannon devices are developed in Table 6, and Table 7 gives the total PM load impact in the state. In Table 5, columns labeled shed kW/switch are the results of simulation runs, scaled as described above, for both 75% cycling (1.5 kW program) and 50% cycling (1.0 kW program) and for hours 16-18 on July 7, 2010. Potential load impacts for CSE devices (next to last column) are calculated from switch counts for each program option in the state on the event day. De-